Substances: Benzo[a]pyrene (BaP); Benzo[e]pyrene (BeP); Benzo[a]anthracene (BaA); Chrysene; Benzo[b]fluoranthene (BbFA); Benzo[j]fluoranthene (BjFA); Benzo[k]fluoranthene (BkFA); Dibenzo[a,h]anthracene (DBAhA)
EC numbers: 200-028-5; 205-892-7; 200-280-6; 205-923-4; 205-911-9; 205-910-3; 205-916-6; 200-181-8
CAS numbers: 50-32-8; 63466-71-7; 192-97-2; 56-55-3; 1718-53-2; 218-01-9; 1719-03-5; 205-99-2; 205-82-3; 207-08-9; 53-70-3

Answers to Call for Evidence specific information requests

Specific information requests:

1. Please provide information on the concentrations of PAHs in plastic or rubber granulates used as infill material in synthetic turf pitches you are producing or importing. In case you have taken samples from pitches, please provide the measurement data. Do you have information on how the rubber granulate changes during use (e.g. changes in the composition after 10-15 years)? (If you have already submitted such information during the preparation of the preliminary report by ECHA, there is no need to resubmit this information.)

2. What are the possible health or environmental aspects and technical/quality aspects and other differences of using alternative substances/mixtures as infill material? We are particularly interested in a comparison of the properties of PAH-containing and PAH-free granulates with regard to health and environmental hazards or risks, service durability, maintenance and replacement requirements, playability in different weather conditions, etc. Please specify all viable alternatives in your reply.

3. As a manufacturer or an importer, please provide information on how many tonnes (metric tonnes) of plastic and rubber infill material (describe which infill material) you are producing or importing every year.

4. What are per unit prices and production costs of different infill materials? Can you provide an estimate of the substitution costs per pitch (including costs for labour, material, disposal of old material, transportation, etc.) when changing from an existing PAH-containing material to a different infill material? Are there any differences with respect to how frequent the whole infill material needs to be changed or replenished, i.e. are there different maintenance costs involved with the use of different infill materials?

5. What are the impacts (positive and negative) on your industry/organisation (manufacturer, distributor, importer, sports club/community owning the field) if a restriction on PAHs in granulates is imposed to lower the limit value to close to those set in the restriction entry 50 on PAHs in articles supplied to the general public? (see: substances restricted under reach)

6. Please provide any information you may have on other substances (e.g metals such as cobalt and zinc, phthalates, benzothiazole and methyl isobutyl ketone) contained in plastic of rubber infill or in synthetic turf pitches (including substances used during the maintenance)) or other relevant information concerning possible risks to human health or the environment.

Ref.	Date/type/Org.	Answers to specific info requests
480	**Date:** 2017/08/23 11:43 **Type:** Individual **Country:** Germany **Name confidential:** Yes	**General comments:** Hallo, I like to mention: Rubber granulate that is put onto/into a sports ground is no more a mixture. Definition of mixture, you remember: "Object with specific form , surface or shape, more important than chemical composition..." The shape of the granulate, the damping behaviour, the filling behaviour between the synthetic blades of grass is relevant. No effects of the chemicals of the rubber are relevant, no release, no chemical reaction required. Any other material with comparable shape, damping is applicable. Therefore the limit for products might be applicable.
		Dossier submitter response:
481	**Date:** 2017/08/29 10:29 **Type:** Individual **Country:** Denmark **Name confidential:** Yes **Privacy statement:** We (the laboratory) perform PAH analysis of rubber granulates for clients and do not want to disturb relations. Feel free to contact for more information.	**General comments:** The suggested PAH only covers the larger PAH molecules. It should be considered to also have requirements for the smaller PAH such as naphthalen, acenapthen, fluoren, phenanthren, anthracen and pyren. These molecules are included in all PAH screeningens where the larger PAH are analysed, so it will not be a cost to industry unless they are present. The smaller PAH are more likely to migrate, so it will make sense to have a limit for these. They are present in a higher degree in pitch granulates than the larger ones, which is also an argument.
		Dossier submitter response:
483	**Date:** 2017/09/13 10:40 **Type:** BehalfOfAnOrganisation	**General comments:** I include several survey that we have conducted over the last years. BSNC is available for comments.

	Org. type: Industry or trade association **Org. name:** Branchevereniging Sport en Cultuurtechniek (BSNC) **Org. country:** Netherlands **Attachment:** 7z ref_483.zip **Privacy statement:** BSNC and VSG are working on a infillmatrix in cooperation with GGD. I have some more documents available but that exceeded the maximum file size of 20Mb. Please contact me if ECHA is interested in these surveys.	**Dossier submitter response:**
520	**Date:** 2017/10/05 14:55 **Type:** MemberState **Country:** Austria **Attachment:**	**General comments:** see attachment **Dossier submitter response:**

	ref_520.docx	
521	**Date:** 2017/10/11 22:31 **Type:** MemberState **Country:** Sweden **Attachment:** ref_521.pdf	**General comments:** We thank the NL and Echa for the initative to prepare a restriction dossier for PAHs in rubber granulates.
		Answer to specific info request 6: In 2016 the Swedish Environmental Agency published a literature study on tyre material in synthetic turfs for football fields (the study was conducted by the consultant company Sweco Environment AB): http://www.naturvardsverket.se/upload/miljoarbete-i-samhallet/miljoarbete-i-sverige/regeringsuppdrag/2016/giftfria-resurser/litt-studie-dackmaterial-konstgrasplaner.pdf Based on information given in the Sweco-report (in the references), KemI conducted in 2016 a search in Echa's C&L Inventory data base and Echa´s dissemination tool in order to map out hazardous properties and regulatory status of the substances identified in the study. The results are in the attached document. Please note, the document should be considered as a draft and the accuracy of the information must be validated before it is used. The document is also in Swedish. Nevertheless, we still consider the information might be useful for the preparation of the restriction dossier.
		Dossier submitter response:
522	**Date:** 2017/10/13 16:16 **Type:** BehalfOfAnOrganisation **Org. type:** Company **Org. name:** MRH Muelsen GmbH **Org. country:** Germany	**General comments:** The bio-availability is crucial, not the content. Nevertheless, the content of PAH in our granules is below 10 mg per kg in total.
		Answer to specific info request 1: In the application of recycled rubber material (tyres, etc.) it is not the content of PAH and other chemicals that is relevant, but the bio-availability for the consumer or user. Only migration testing and the subsequent risk assessment are an indicator for possible health risk - not an extraction of all components in a sample. The analysis method should be changed and adapted in order to grant an realistic view of health risk. Alternative methods have been presented in the recent past.

		Answer to specific info request 2: Alternatives with "fresh" material will always use primary ressources, meaning that fossile and natural raw materials must be used to produce new products. Due to that, those new products would be more price-intensive. This totaly disrespects the idea of circular economy. As stated in point 1), rubber granules are a crucial contribution to circular economy, save natural ressources and present no objective, measurable risk for health or environment. In addition, our granules are most suitable to support sport functional characteristics. This feature is maintained over a long period, which results in a longer period of usability.
		Answer to specific info request 3: As a manufacturer, we produce 4.000 tons of rubber granule per year.
		Answer to specific info request 4: Please refer to point 1) and 2).
		Answer to specific info request 5: A further reduction of the limit value would have the consequence that the entire recycling-sector is damaged. That does not correspond to the thoughts of european circular economy.
		Answer to specific info request 6: In our manufacturing there are no relevant chemical additives which cause a change in the starting material.
		Dossier submitter response:
523	**Date:** 2017/10/16 14:18 **Type:** MemberState **Country:** Denmark **Attachment:**	**General comments:** The following may have further information: RUBCOM, v.[redacted] tel. [redacted] www.RUBCOM.com NKI, [redacted], tel. +[redacted], www.kunstgraes.com Genan, [redacted] tel. +45 [redacted] www.genan.eu
		Dossier submitter response:

	ref_523.zip	
524	**Date:** 2017/10/16 17:53 **Type:** BehalfOfAnOrganisation **Org. type:** Academic institution **Org. name:** Utrecht University, Institute for Risk Assessment Sciences **Org. country:** Netherlands **Attachment:** ref_524.pdf	**Dossier submitter response:**
525	**Date:** 2017/10/16 21:22 **Type:** BehalfOfAnOrganisation **Org. type:** Company **Org. name:** RECIPNEU **Org. country:** Portugal **Attachment:**	**General comments:** In the answer to the present ECHA call for comments and evidence, considering the information presented in the Document "ANNEX XV REPORT - AN EVALUATION OF THE POSSIBLE HEALTH RISKS OF RECYCLED RUBBER GRANULES USED AS INFILL IN SYNTHETIC TURF SPORTS FIELDS" (ECHA, 28 February 2017), I will provide in the subsequent Points some additional technical information of interest to be considered in ECHA, after introducing myself and my Company as follows: - [redacted] having a chemical background [redacted], Technical University of Lisbon) and a [redacted] technical experience, professional and scientific, in the area of activity "tyre recycling and technical applications of tyre recycled materials", namely with the following EU specific involvements: [redacted]

Doc. 20.a

	ref_525.zip	[redacted] RECIPNEU, www.recipneu.com, a Portuguese major tyre recycling Company using the cryogenic technology, being in this field a reference in EU, produces and exports since its start-up in 2001 different grades of its proprietary Cryoflex® cryogenic rubber infill tyre rubber granulates, used successfully and technically approved as a first class infill material in synthetic turf pitches in European Countries, and also in Americas, Middle East and Africa, complying with the actualised technical terms prescribed by FIFA Manuals, and with the present health and environmental EU regulations. As a technical contribution for this Call to be emphasized and shown in some detail, additionally to the points described in the ANNEX XV REPORT, I will describe the very different intrinsic technical characteristics of the two different main types of tyre recycled rubber granulates, those obtained by a cryogenic technology (like in the case of RECIPNEU) and those obtained by the usual, traditional, and generalized in Europe 'ambient/mechanical grinding technologies' (not cryogenic); these two different types of rubber granulates (cryogenic, and ambient/not cryogenic) are really different products, which justify a separate technical classification and approach regarding health and environment risks, being the cryogenic rubber infill granulates that do have a much better profile, showing significantly a better behaviour in what concerns the exposure parameters regarding the characteristics considered to qualify the health and environment risks. Important Note: In our opinion, this fact doesn't disqualify the 'ambient / mechanical' (not cryogenic) usual/traditional rubber infill granulates for the market application of infilling synthetic turf sports fields, but in this answer to the Call it was decided to focus and individualize the superior health and environment characteristics/behaviour of the cryogenic rubber infill granulates, because they are not mentioned technically with sufficient detail in the ANNEX XV REPORT.
		Answer to specific info request 1: The information on the concentrations of PAHs in the RECIPNEU Cryoflex® cryogenic rubber infill tyre rubber granulates, used as infill material in synthetic turf pitches, is presented in the attached Annex files, showing the individually Lab test results of PAHs determinations in RECIPNEU cryogenic rubber infill grades, done in two different times - 2006 and 2017 - respectively by TÜV Rheinland

		Group, covering 16 PAHs (in 2006), and by ICTPOL, Instituto de Ciência e Tecnologia de Polímeros, IST Lisbon, covering 18 PAHs (in 2017), this last one according to 'AfPS GS 2014:01 PAH specification'. The test results show a substantial decrease in the sum of the concentrations of the considered PAHs, from the range of 50 mg/Kg in 2006 (for the total of 16 PAHs), to the range of 5 mg/kg in 2017 (for the total of 18 PAHs). In this last case, it is important to point out that in the test results obtained in 2017 in the grades of RECIPNEU cryogenic rubber infill granulates, only for the sum of the concentrations of the 'restricted PAHs (EU-8)', the total values for the sum of 'EU-8 PAHs' are all in the interval [1.1–1.5 mg/kg], being the individual results for that sum <1.2 mg/kg, <1.49 mg/kg, <1.14 mg/kg, and <1.35 mg/kg (much less than the sum for the 18 PAHs in the range of 5 mg/kg). This situation reflects the ban since 1 January 2010 of the use of high-PAH oils for the production of tyres in EU, and also, more recently, the "greening" composition of carbon black, action undertaken by the principal carbon black world producers regarding the decrease of levels in PAH content (see "The greening of carbon black", www.compoundingworld.com, November 2016); therefore, technically, it may be considered that the health risks derived from the PAHs content in the tyre rubber derived from these two main sources of PAHs (oils and carbon black) will decrease more and more in the future for the tyres produced in the EU, reflecting also a similar tendency in the decrease of PAHs, in general, in the recycled tyre rubber granulates; however, due to its intrinsic technical characteristics, in the case of cryogenic rubber infill granulates the situation concerning PAHs (like in all the other health and environment risks) is significantly better. Also the ISO 21461 test done in 18 February 2013 on RECIPNEU cryogenic rubber infill, in Attachment, was compliant regarding the determination of 1H-NMR bay-proton analysis, to classify the aromacity of oil in vulcanized rubber compounds
		Answer to specific info request 2: Cryogenic rubber infill granulates - although being considered in the ANNEX XV REPORT as belonging to the usual/traditional 'ambient' rubber infill granulates as "PAH-containing granulates", like also in the generic technical literature, and in many of the attached Documents and Reports presented under this answer to the ECHA Call - due to the fact that they have a much reduced content levels of PAHs, we claim that they could properly be considered from now on as a different "alternative substances/mixtures as infill material" (like mentioned in the Point 2: above), due to the fact that its exposure parameters regarding health and environment hazards or risks really show much better profile, and much better technical characteristics, when compared with the usual/traditional 'ambient' recycled rubber infill granulates. In fact, Cryoflex® cryogenic rubber infill granulates have a minimal specific surface morphology

		area (very low pore density), originating minimal or negligible emissions or leachates, exhibiting practically no rubber smell – see attachment 08; complies with Standards DIN V 18035-7 and NF P90-112 (concerning heavy metals leachates and other organic pollutants) – see attachments 09, 10, and 11; the content in the Product, as is, of Inhalable Dusts (PM2.5 and PM10) is negligible – see attachment 13. Also in the other mentioned characteristics (with regard to service durability, maintenance and replacement requirements, playability in different weather conditions, etc.), the cryogenic rubber infill granulates do have much better profiles, namely in the following aspects/characteristics, imparting an excellent durability and performance to synthetic turf sports fields – see attachments 14 and 15: - Maintenance and replacement requirements; - Playability in different weather conditions; - Superior abrasion resistance; - Superior compaction resistance; - Excellent drainage (the pitch never gets flooded). A short Product Description of Cryoflex® cryogenic rubber infill granulates: Vulcanized rubber in granulate, obtained by cryogenic size reduction of whole tyres. The metal and textiles of the tyres are removed, product constitution is almost exclusively rubber. The cryogenic grinding process of the rubber compound is done with liquid nitrogen at very low temperatures, below - 80ºC, surpassing the 'Glass transition point' of all the rubber polymers of the tyre, causing the fracture of the rubber material in small sized rubber particles due to the instant impact grinding, without causing any friction and any degradation - of molecular weight, thermal, oxidative, or devulcanization - in the rubber polymer chains, keeping the excellent elastic, mechanical, and anti-ageing initial tyre rubber compound properties, along with exceptional abrasion resistance and non-powderizing effects. Therefore, accordingly with existing EU regulations and studies, cryogenic rubber infill granulates do have very favourable health and environment profiles, imparting excellent durability and performance to synthetic turf sports fields – see resumed Product Information aspects in the attachments 16 and 17. As a complementary informative documentation on other infill materials, see in the attachment 18 the study done in 2007 "ENVIRONMENTAL AND HEALTH RISK STUDY comparing different infill materials (Tyre Rubber granulates, TPE granules, and EPDM granules) – CEN TC 217 'Env. Task Force', 2007" - Research setup in France by Laboratory EEDEMS, Environmental Agency ADEME, and ALIAPUR.

		Answer to specific info request 3: In the attachment 19 is presented the production and supply of all the product grades of its proprietary Cryoflex® cryogenic rubber infill material: "Cryoflex® cryogenic rubber infill - Recycled tyre rubber granulates produced and supplied by RECIPNEU for infilling synthetic turf sport fields in the period 2001 - 2017" It shows a regular high level of supply since the start up until now, despite some decreases occurred in 2012 and 2013, during the recent EU economic crisis period. The global supply of cryogenic rubber infill granulates since the beginning of the production in 2001 until the end of 2017 totalizes the amount of 89.833 metric tons (including the estimation for the last 3 months of 2017); the representative average supply per year for the 17 years is in the range of 5.300 metric tons/year, but excluding the "problematic" years 2012 and 2013, then the "normal" representative average supply per year for the other 15 years is in the range of 5.700 metric tons/year.
		Answer to specific info request 4: From the ANNEX XV REPORT, the indication for the estimated price levels regarding the different infill materials are: Tyre recycled granulates: 500 EUR/ton; EPDM-TPO-TPE: 2.000 EUR/ton. However, as per RECIPNEU practical market knowledge regarding the two types of ELT rubber infill granulates, cryogenic and ambient, the actualized price levels (C+F basis) in generic EU destinations are: Cryogenic rubber infill: EUR 350 - 400/ton; Ambient rubber infill: EUR 250 - 300/ton. Regarding the levels of production costs for these two types of rubber infill obtained by tyre recycling, we can say that the cryogenic rubber infill has a significant surplus production cost due to the massive quantity of liquid nitrogen used in the cryogenic recycling process. However, that extra cost, leading to an extra price per ton, at the end economically compensates the clients due to a bigger durability plus important savings in different maintenance costs that, in case of use of 'ambient' (not cryogenic) rubber infill, would occur during all the life-time of the pitch – due to rubber refills, occurrences of flooding, infill compaction, re-certification of the pitch (FIFA* and FIFA** requirements), and savings in possible additional "health and environment" expenses. In what concerns the "substitution costs per pitch" in case of changing from an existing PAH-containing material to a different infill material, we believe and accept the conclusions of the detailed study of VACO and ReciBEM, dated 6 November 2015, presented in attachment 20, "Position paper on PAH restriction for rubber infill": The total costs to substitute the ELT rubber infill existing in the synthetic turf sports fields in EU would be in the level of EUR 2.4 billion!

		Answer to specific info request 5: In the case of RECIPNEU, in agreement with the previously described in Point 1: of this answer to the Call, due to the very reduced low levels of PAHs determined for the restricted PAHs (EU-8) in our cryogenic rubber infill granulates – being the sum of concentrations of the 'EU-8 PAHs' in the interval [1.1–1.5 mg/kg] - we don't foresee any special negative impact if a restriction on PAHs decreases the actually existing levels for the restricted PAHs (EU-8), the "EU-8 carcinogenic PAHs". However, in case of such decision be made, we believe that all the other tyre recyclers in EU, that use the 'ambient' usual mechanical grinding technologies (not cryogenic), will have a huge problem, and their activity will be completely affected and probably will collapse. Really, as per information from ANNEX XV REPORT, in EU the use of recycled ELT granulates as rubber infill in synthetic turf and shock-absorbing surfaces are the two most important markets for the ELT recycling sector: they represent about 54% of the European ELT recycled market; the ESTO states in 2016 that there are over 13.000 synthetic turf football fields within the EU and over 47.000 minipitches used for football. Data from the major synthetic turf manufacturers and the ELT granulators operating in the EU indicate that around 1.200 – 1.400 new football fields are nowadays installed every year in the EU. This includes the replacement of old fields. According to ESTO, the number of fields is expected to continue to grow, e.g. by 2020 the number of football fields with synthetic turf is expected to be about 21.000 and the number of minipitches around 72.000. Based on industry estimates (ETRMA, 2016), the quantity of ELT rubber infill that is used on European sport fields is about 80.000 to 130.000 tonnes per year, being ELT granulates by far the most common and almost exclusive form of infill used (in 2015, EPDM granulates represented 0.3% and TPEs 1% of EU infill materials). All the above information, showing clearly that in the present exists a huge quantitative market demand, expected to increase in the near future, reinforces the assumption that the ELT rubber infill materials are - and will be more and more - the only valid and practical market answer to infill the synthetic pitches in the EU. NOTE: Now, as a "side comment", we in the EU have to recognize that, if there is a real health and environment problem due to the presence of rubber infill granulates in synthetic pitches for sportive practitioners, where the total quantities of rubber infill granulates are around 80.000 to 130.000 tonnes per year, then what to think about the situation regarding the liberation every year in the EU of around 600.000 tonnes per year of respirable abraded tyre rubber particles, as a result of the traffic circulation in all the EU roads, which are in daily contact with all the citizens in all the EU cities and countries? (this value is taken from the well accepted estimation in EU that when a tyre gets is end-of-life situation, it has lost about 20% of weight due to the road abrasion in its traffic circulation period of life during some years; in the EU, the total quantity generated per year of ELTs is close to 3.4 million tonnes per year, from where 20% of that weight totalizes around 600.000 tonnes per year)

		And adding to this 'tyre situation', what to think about the enormous daily particulate emissions, certainly with a lot of PAHs resulting from the combustion of diesel and gas motors in the vehicles in circulation all over EU cities?
		Answer to specific info request 6: RECIPNEU has done in the past many leaching tests to characterize and approve its rubber infill products in what concerns environmental aspects, accordingly with the technical requirements at that time - the compliance with the standards DIN V 18035-7 and NF P90-112 tests. As an illustration, please see the attachments 09 and 10, the Documents of 26 April 2008 showing the test results and requirements of the leaching tests made in SGS Fresenius Institut, Berlin, by [redacted] in which all the test results obtained for the grades Cryoflex® cryogenic rubber infill DC-0814 and DC-1430 of RECIPNEU are OK, regarding the Lab determinations of EOX (Extracted Organic Halogens), DOC (Dissolved Organic carbon), and Heavy Metals. More recently, in the attachment 11, Labosport has done a complete test report on the RECIPNEU grade Cryoflex® cryogenic rubber infill DC-0725, in 11 February 2015, showing the compliance with many EU environmental regulations, leaching, weathering, drainage, toxicology and environment, UVA and UVB ageing, etc. As a Final Note, following the Scientific Note of [redacted] well documented and presented in the attachment 21, "Examination on E.L.T. granulates, 2016-12-20, ICTPOL – IST", we also strongly believe that, as considered in the above described leaching tests done by SGS Fresenius Institut, Berlin, and Labosport, France, the important criteria to be considered regarding the possible risks to human health or the environment derived from PAHs and chemical substances of the tyre rubber composition, is the "Exposure criteria" and not the "Content criteria".
		Dossier submitter response:
526	**Date:** 2017/10/17 09:57 **Type:** Individual **Country:** Germany	**General comments:** The bio-availability is crucial, not the content.
		Answer to specific info request 1: In the application of recyled rubber material (tyres, etc.) it is not the content of PAH and other chemicals that is relevant, but the bio-availability for the consumer or user. Only migration testing and the subsequent risk assessment are an indicator for possible health risk - not an extraction of all components in

		a sample. The analysis method must be changed and adapted. Alternative methods have been presented in the recent past.
		Answer to specific info request 2: Alternatives with "fresh" material will always use primary ressources, meaning that fossile and natural raw materials must be used to produce new product. This totaly disrespects the idea of circular economy. As stated in point 1) rubber granules are a crucial contribution to circular economy, save natural ressources and present no objective, measurable health risk.
		Answer to specific info request 4: please refer to point 1) and 2)
		Dossier submitter response:
527	**Date:** 2017/10/17 11:30 **Type:** BehalfOfAnOrganisation **Org. type:** Industry or trade association **Org. name:** ETRMA **Org. country:** Belgium **Attachment:**	**General comments:** ETRMA is the leading voice of tyre and rubber goods producers. Since 1959, the Association is devoted to advocating the interests of the tyre and rubber manufacturing industries with the European Union institutions and other international organizations. ETRMA contributes to ensuring the development, competitiveness and growth of the tyre and rubber industry in contributing to all the initiatives in favour of health, safety & environment protection, transport and road safety and access to third markets in coordination with the European public authorities. The European tyre and rubber industry employs directly more than 360 000 people with a turnover of €73B in 2016, which constitutes about half a point of the EU turnover. ETRMA's membership include the following tyre manufacturers: APOLLO VREDESTEIN, BRIDGESTONE EUROPE, BRISA, COOPER TIRES, CONTINENTAL, GOODYEAR DUNLOP TIRES EUROPE, HANKOOK, MARANGONI, MICHELIN, NOKIAN TYRES, PIRELLI TYRE, PROMETEON Tyre S.r.l., and TRELLEBORG WHEEL SYSTEMS. Associations in the following countries are also members of ETRMA: Belgium, Finland, France, Germany, Hungary, Italy, the Netherlands, Poland, Spain and the UK.

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Privacy statement:
The information attached in the confidential annex should not be disclosed because it might undermine the intellectual property</td>
<td>Answer to specific info request 1:
In partnership with FoBig – a expert risk characterization consultant – ETRMA and CRIP (Crumb Rubber Industry Platform) launched the project on the "Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF)" (called hereunder FoBig study) earlier this year. More than 50 samples of recycled crumb rubber from end-of-life tyres (hereafter called ELT – derived rubber) will be collected, including samples of crumb rubber from recycling plants and directly from fields with STF from outdoor and indoor facilities.
The study will characterize the content of the eight PAHs referred to in entry 50 of the REACH legislation and other substances that are suspected to be present in STF from literature review. As no established and accepted method of measurement of the content of PAH is available, the DIN ISO 12884 standard with elution with Cyclohexane/Toluene will be applied for the determination of the content of PAH in ELT – derived rubber. The first results on PAH content from the Fobig study are expected by February 2018.
Comparable results on the content of PAH in crumb rubber require an established and accepted method of measurement. We encourage authorities to consider data on PAH content on rubber crumb that use well known and recognized measurement methods. Further, in view of setting restriction criteria on the content of PAH in infill of STF, authorities should introduce an internationally harmonized standard for measuring PAHs.
Regarding the effects of aging in crumb rubber used in STF, at this stage, there are no reasons to link effects of aging with the content of PAH. During the use of crumb rubber in STF, VOCs might be potentially generated, for instance phenol, formaldehyde, ethanol or methanol - (more information is available on the comments already submitted to ECHA in the context of preparing the report on "An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.", Version 1.01 of February 2017- and attached to this CoE for your convenience)
The Fobig study will perform on several samples weathering experiments that aim to identify the potential effects of time and weather on the composition and on the generated substances. The results are expected not earlier than December 2018.
More information is available in the document attached</td>
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<td>Answer to specific info request 2:
ETRMA members are producers of tyres that, after their service life, are used to produce crumb rubber infill. The content of PAH in the oils used in the production of tyres is strictly regulated under entry 50 paragraph 1 of the REACH regulation. This measure guarantees safe conditions for the expected use of tyres for the human health and the environment.
End of life tyres (ELT) are the main source of raw material for recycled crumb rubber. It has proven to be a reliable material able to reply to the demanding technical requirements of infill of STF. Using</td>
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		ELT for infill of STF closes the recycling loop of tyres and helps Europe to meet its circular economy targets. However some other materials that are suspected to be the source of impurities and high PAH content might be added in crumb rubber beyond ELT. Often this is neglected by researchers and has a tremendous impact on the final crumb rubber composition. Those non-suitable sources are for instance - rubber from other applications than tyres or post-consumer rubber scrap containing rubber from other applications than tyres. ELT-derived crumb rubber – without non-suitable sources - has levels of PAH in the range of 20 ppm that do not pose a risk for the human health for all users of STF (players, workers, installers to name some). ECHA´s report An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields. Version 1.01 of February 2017- concludes in page 57 ´ that based on the available information, with the concentrations of polycyclic aromatic hydrocarbons (PAHs) found to be typically present in rubber crumb recycled from ELTs used as infill in synthetic sports fields), the concern for excess lifetime cancer risk for players and workers is very low.´ We support a restriction to control the risk of high PAH in rubber infill that targets "rubber granulates used as infill material in synthetic turf sport" and sets thresholds that guarantee safe use conditions. The scope should cover not only ELT- derived rubber but any other recycled material used as infill material and virgin ones. Additionally a restriction will need further regulatory measures to successfully control risk, such as: - Establishing of clear end of waste criteria at EU level ELT Rubber granulates are currently considered as waste by a majority of Member States. If a restriction is introduced, its efficiency will be put into question as waste is outside of the scope of REACH. We strongly recommend that clearly defined end of waste criteria are introduced at EU level to ensure consistent interpretation of the scope of the restriction and guarantee legal certainty. The end of waste criteria should include chemical criteria reflecting the current regulatory requirements on the presence of chemicals and their concentration limits. ETRMA is willing to work with the institutions and contribute to the preparation of the end of waste criteria Strong market surveillance across the EU ECHA report acknowledges that some imported tyres entering the EU or other rubber material with unknown composition can be converted at the end of their life cycle into rubber granulates and may have different concentrations of substances than those produced from EU ELT. Indeed rubber granulates themselves may be imported, and the composition of such granulates is not known. We would like to take the opportunity to remind that the efficient implementation of the restriction depends essentially on a clear definition of the scope and consistent interpretation, but also on strong market surveillance, which is critical for guaranteeing protection to consumers and level playing field for industry. Introducing of international harmonized criteria for measuring of PAHs – as previously mentioned

		Currently, there are no robust and internationally recognised sampling protocols and test methods that could allow article manufacturers to test their product and national authorities to ensure the necessary enforcement. We urge the EU institutions to treat the development of test methods as a high priority, as the efficiency of the measure and its coherent enforcement is at stake. ETRMA is committed to work on the development of a test method to measure the level of PAHs contained in vulcanised rubber materials. We strongly support the ongoing work of JRC which aims at developing a method to measure the migration of PAHs from rubber products
		Answer to specific info request 3: Globally, the infill demand for artificial turf is about 1,3 million tons, from which more than 90 % is estimated to be covered by SBR- which commonly refers to ELT-derived rubber. A detailed overview of the main uses of ELT-derived rubber and the estimated percentage share by use of the overall market is available hereunder: - Synthetic turf (30% of the overall market): ELT-derived rubber granulates are a valuable infill material that is used to provide proper resiliency and shock absorbance to the artificial turf playing fields. - Sport Surfaces/athletic tracks and shock absorbing pavements (24% of the overall market): ELT-derived rubber can be used in many outdoor sport areas (primarily for athletics, multi-use sports,) to dissipate the vibrations and impacts that otherwise would affect the muscle-skeleton apparatus of the athletes. ELT-derived rubber is also used in indoor surfaces (for ex. volley, basket), generally with a PU top coating but this represents a small volume compared to outdoor surfaces. - Moulded rubber goods (24% of the overall market): ELT rubber granulates and powders can be mixed with polyurethane binders to produce "re-moulded" rubber articles such as wheels for trolleys (e.g. caddies, dustbins wheelbarrows, etc), urban furniture, safety corners, rail filler block systems, etc. - Other applications (22% of the overall market): Asphalt rubber, Equestrian floor, … (more information is available on the comments already submitted to ECHA in the context of preparing the report An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields. Version 1.01 of February 2017- and attached to this CoE for your convenience)
		Answer to specific info request 5: We consider current PAH concentrations of ELT-derived rubber - in the range of up to 20 ppm - as the lowest feasible concentration for ELT-derived rubber. A lower content of PAH – as the one for rubber goods stated in the restriction entry 50 P 5 and 6 - will not be achievable using exclusively

		ELT as raw material and will compromise the current ELT recycling chain. A lower threshold for ELT-derived rubber used as infill material in synthetic turf fields will de-facto exclude ELT-derived rubber from the infill market, currently the first source of raw material for infill, and unavoidably it will distort the current infill market for STF. It will also affect ELT-derived rubber producers, as infill for STF represents 30% of the overall market of ELT-derived rubber, and alike applications, such as sport or shock adsorbing pavements that might also be indirectly affected by the restriction, representing 24% of the share, altogether adding up to 54% of the overall ELT – derived rubber market. (More information on ELT-derived rubber uses is available on the comments already submitted to ECHA in the context of preparing the report "An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.", Version 1.01 of February 2017- and attached to this CoE for your convenience). ETRMA is conducting a Socio-Economic Impact Assessment to address the consequences of restriction scenarios, and to identify and quantify the consequences for ELT-derived rubber markets and society. The results are expected to be available by end of November 2017. More information is available in the document attached
		Answer to specific info request 6: As previously discussed, in partnership with Fobig- a expert risk characterization consultant – ETRMA and CRIP (Crumb Rubber Industry Platform) launched the project Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF) (informally called Fobig study) earlier this year. More than 50 samples of ELT – derived rubber will be collected, including samples of crumb rubber from recycling plants and directly from fields with ELT derived rubber as infill material, from outdoor and indoor facilities. The study will look at the content of other substances suspected to be present in STF beyond PAH, namely metals (such as cobalt or zinc) or benzothiazoles. We expect that the results will confirm current ETRMA knowledge on the presence and content of other substances in ELT-derived rubber, resumed hereunder. However, we would recommend to focus the restriction on PAHs, as for the time being, there is insufficient knowledge about the presence of other substances in crumb rubber and their concentration level. More information is available in the document attached
		Dossier submitter response:

528	**Date:** 2017/10/17 15:45 **Type:** BehalfOfAnOrganisation **Org. type:** Company **Org. name:** BSW Berleburger Schaumstoffwerk GmbH **Org. country:** Germany	**General comments:** BSW does not produce or import turf infill material but we process about 60.000 metric tons of end of life tyre material into a variety of building and industrial products. As a manufacturer have we closely monitored the PAH content of our products and over time performed in excess of 1.000 PAH analyses over the past 10 years. Hence, we have precise information on the PAH content of end of life tyre granules. It is impossible to attach more than 1.000 Analysis data, but what we can say is the following: After the ban of PAHs in plasticizer oils in the EU in 2010 have the PAH contents of end of life tyre granulates gone down. The overall content of the 16 EPA-PAH is generally between 30 and 35 mg/kg and the granules comply with EU 1272/2013 meaning that almost always is their PAH content under 1 mg per kg of the eight single PAH mentioned in EU 1272/2013. These results come if the analysis is carried out using the DIN standard 18287. This standard was commonly accepted (including by the DIBt in Berlin) and partly was its use mandatory. Only recently has the DIBt in Germany shifted to use the AfPS standard. AfPS works with toluol as a solvent heated to 60°C and produces PAH readings that are roughly 60 - 70 % higher than the readings produced by DIN 18287. Leaving DIN 18287 and shifting to AfPS would therefore mean that end of life tyre products will very seldom comply with EU 1272/2013. Products considered safe for customer use by all participating authorities for many years will overnight become unacceptable just because the analysis has to be carried out according to AfPS. The DIBt in Germany has recently shifted from DIN 18278 to AfPS and will soon be confronted with the problem that the use of end of life tyre granules in Germany will be severely restricted. ECHA needs to understand that the adoption of the AfPS analysis standard alone will make it almost impossible to use end of life tyre granules anymore - just and exactly the material that was thoroughly monitored and considered safe if analysed according to DIN 18287. Hence, any attempts by Germany to persuade ECHA to use AfPS as an analysing standard will inevitably end in an end of life tyre problem in the EU as most of the building and consumer products now considered safe under DIN 18287 will go over the limits if analysed according to AfPS. Europe has decided to ban the landfilling of tyres and is heavily restricting burning them. The last remaining reasonable alternative for end of life tyres is now granulating them. This will come to an end if granulates as raw material are not considered safe anymore for building and consumer products. Illegal dumping of tyres will again be a problem if EU legislation puts an end to the use of end of life tyre granulates.
		Answer to specific info request 1: In the application of end of life tyre granulates the bio-availability of PAH is the decisive factor. It is a mistake to only look at the PAH content as PAH is firmly bound in the molecular structure of vulcanised rubber. Therefore migration testing and subsequent risk analysis must be undertaken. The extraction of all PAH from a given piece of rubber does not allow any conclusion on how

		dangerous the use of this piece of rubber would be.
		Answer to specific info request 4: Generally one can calculate with abt. EUR 0,20 per kg for end of life tyre granulates. Alternative materials, f. e. EPDM, will cost abt. EUR 1,75 plus per kg.
		Answer to specific info request 5: Please refer to the general comments above. Strict restriction of PAH contents in building products and consumer goods - and especially the adoption of the AfPS analysis standard - will cause the problem that the EU countries quickly will not know what to do with end of life tyres anymore. Illegal dumping of tyres will be the consequence. Also, the idea of a circular economy is completely negated if end of life tyre granules are banned. Such end of life tyre granules present no measurable risk. A recent study by the Fraunhofer Institut in Germany is clearly proving that. The Fraunhofer Institut should be happy to contribute the study. If not, the undersigned will make it available.
		Dossier submitter response:
529	**Date:** 2017/10/17 21:59 **Type:** BehalfOfAnOrganisation **Org. type:** Industry or trade association **Org. name:** European Synthetic Turf Organisation **Org. country:** Belgium	**General comments:** ESTO is part of the CRIP (Crumb Rubber Industry Platform) that has launched the project on the "Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF)" (called hereunder FoBig study) earlier this year. More than 50 samples of recycled crumb rubber from end-of-life tyres (ELT – derived rubber) will be collected, including samples of crumb rubber from recycling plants and directly from fields with STF from outdoor and indoor facilities. The study will characterize the content of the eight PAHs referred to in entry 50 of the REACH legislation and other substances that are suspected to be present in STF from literature review. As no established and accepted method of measurement the content of PAH is available the Fobig study will apply the DIN ISO 12884 with elution with Cyclohexane/Toluene for the determination of the content of PAH in ELT – derived rubber. The first results on PAH content from the Fobig study are expected by February 2018. Comparable results on the content of PAH in crumb rubber require an established and accepted method of measurement. We encourage authorities to consider data on PAH content on rubber crumb that uses well known and recognized measurement methods. Further, in view of setting restriction criteria on the content of PAH in infill of STF, authorities should introduce an international

harmonized standard for measuring PAHs.

Answer to specific info request 1:
Currently, and until Fobig is ready, ESTO estimates that the content of PAH in ELT-derived rubber may be in a range of up to 20 ppm, slightly varying between the origin of tyres, as seen is the table hereunder.

Table 1 – PAHs* in ELT-derived rubber granulates
sum of 8 restricted PAHs*ppm

	Mean	Min	Max
Total	12	4	20
T&B	11	4	18
Mix	12	4	20
OLD	12	4	20
NEW	11	4	19
Unsorted	8	6	10

*PAH:
(a) Benzo[a]pyrene (BaP) CAS No 50-32-8
(b) Benzo[e]pyrene (BeP) CAS No 192-97-2
(c) Benzo[a]anthracene (BaA) CAS No 56-55-3
(d) Chrysen (CHR) CAS No 218-01-9
(e) Benzo[b]fluoranthene (BbFA) CAS No 205-99-2
(f) Benzo[j]fluoranthene (BjFA) CAS No 205-82-3,
(g) Benzo[k]fluoranthene (BkFA) CAS No 207-08-9
(h) Dibenzo[a,h]anthracene (DBAhA) CAS No 53-70-3

Source: Istituto Mario Negri, "Exposure to Recycled Tyre Rubber, Human Health & Safety", E. Davoli et al, 2016 (unpublished) and Characterization of rubber recycled from ELTs and assessment of the risks associated with dermal and inhalation exposure – Ecopneus 2015 (unpublished)

Legend: T&B= 100% truck and bus tyres, Mix: from 8:92 to 70:30 mixes of T&B/PCT, PCT: Passenger Car tyres

Old= Production ante 2010, New= Production post 2010, Total: 25 samples, Unsorted= crumb rubber from 5 recycling facilities

Regarding the effects of aging in crumb rubber used in synthetic turf fields, at this stage, there are not reasons to link effects of aging with the content of PAH. During the use of crumb rubber in fields, VOCs might be potentially generated, for instance phenol, formaldehyde, ethanol or methanol - (more information is available on the comments already submitted by ETRMA to ECHA in the context of preparing the report on "An evaluation of health risk of recycled rubber granules

		used as infill in synthetic turf sport fields.", Version 1.01 of February 2017) The Fobig study will perform on several samples weathering experiments that aim to identify the potential effects of time and weather on the composition and on the generated substances. The results are expected not earlier than December 2018.
		Answer to specific info request 2: Most infill used in Europe is sourced from REACH compliant European tyres. The content of PAH in the oils used in the production of these tyres is strictly regulated under entry 50 paragraph 1 of the REACH regulation. This measure guarantees safe conditions for the expected use of tyres for the human health and the environment. End of life tyres (ELT) are the main source of raw material for recycled crumb rubber. It has proven to be a reliable material able to reply to the demanding technical requirements of infill of synthetic turf fields. Using ELT for infill of fields closes the recycling loop of tyres and helps Europe to meet its circular economy targets. It is recognised that a range of alternative infill materials (TPE, EPDM, organic infills and blends of the aforementioned) are also used and other materials might be added to infill considered to be ELT. These may be a source of impurities and higher PAH content. ELT-derived rubber – without non-suitable sources - has levels of PAH in the range of 20 ppm that do not pose a risk for the human health for all users of synthetic turf fields (players, workers, installers to name some). ECHA´s report An evaluation of health risk of recycled rubber granules used as infill in synthetic turf sport fields. Version 1.01 of February 2017- concludes in page 57 ´that based on the available information, with the concentrations of polycyclic aromatic hydrocarbons (PAHs) found to be typically present in rubber crumb recycled from ELTs used as infill in synthetic sports fields), the concern for excess lifetime cancer risk for players and workers is very low.´ ESTO supports a restriction to control the risk of high PAH in all forms of infill material used as infill material in synthetic turf" and sets thresholds that guarantee safe use conditions. The scope should must cover not only ELT- derived rubber but all recycled and virgin materials used as infill. Additionally, a restriction will need further regulatory measures to successfully control risk, such as: Establishing of clear end of waste criteria at EU level Rubber granules are currently considered as waste by a majority of Member States. If a restriction is introduced, its efficiency will be put into question as waste is outside of the scope of REACH. ESTO recommend that clearly defined end of waste criteria are introduced at EU level to ensure consistent interpretation of the scope of the restriction and guarantee legal certainty. The end of waste criteria should include chemical criteria reflecting the current regulatory requirements on presence of chemicals and their concentration limits. Strong market surveillance across the EU

		ECHA report acknowledges that some imported tyres entering the EU or other rubber material with unknown composition can be converted at the end of their life cycle into rubber granules and may have different concentrations of substances than those produced from EU ELT. Indeed rubber granules themselves may be imported, and the composition of such granules is not known. We would like to take the opportunity to remind regulatory authorities that the efficient implementation of the restriction depends essentially on a clear definition of the scope and consistent interpretation, but also on strong market surveillance, which is critical for guaranteeing protection to consumers and level playing field for industry. Introducing of international harmonized criteria for measuring of PAHs – as previously mentioned Currently, there are no robust and internationally recognised sampling protocols and test methods that could allow article manufacturers to test their product and national authorities to ensure the necessary enforcement. We urge the EU institutions to treat the development of test method as a high priority, as the efficiency of the measure and its coherent enforcement is at stake. ESTO supports the work of ETRMA to work on the development of a test method to measure the level of PAHs contained in vulcanised rubber materials.
		Answer to specific info request 3: Globally, it is estimated in 1,3 million tons of infill is used in synthetic turf, of which more than 90 % is estimated to be described as SBR- the common name of ELT-derived rubber.
		Answer to specific info request 4: The quantity of infill used in a field will depend on a number of factors including the pile height, sports needs and infill type. Using crumb rubber as a benchmark, EPDM infill costs approximately 3.75 as much and cork is approximately 3 times as much. It also needs to be considered that some alternative infills do not provide as much performance as crumb rubber, meaning some form of shock absorbing pad is required under the synthetic turf. This will also increase installation costs. Many organic based infills float in wet weather and are susceptible to wind erosion when dry. This means on-going topping up of infill is required at an on-going maintenance costs.
		Answer to specific info request 5: We consider current PAH concentrations of ELT-derived rubber - in the range of up to 20 ppm - as the lowest feasible concentration for ELT-derived rubber. A lower content of PAH – as the one for rubber goods stated in the restriction entry 50 P 5 and 6 - will not be achievable using exclusively ELT as raw material and will compromise the current ELT recycling chain. A lower threshold for ELT-derived rubber used as infill material in synthetic turf fields will de-facto

		exclude ELT-derived rubber from the infill market, currently, the first source of raw material for infill, and unavoidably it will distort the current infill market for fields. It will also affect ELT-derived rubber producers, as infill for fields represents 30% of the overall market of ELT-derived rubber, and alike applications. Cost is a major consideration to many when considering a new synthetic turf field and the market is price sensitive. Significant cost increases will reduce the number of fields and the opportunities for communities to participate in sports activities. If new regulation are brought in that effectively exclude ELT the implications for the many of thousands of existing fields could be huge. A concerned public make demand fields at closed until infill can be replaced - which in many cases would mean total resurfacing at a cost in excess of €200,000 per field.
		Answer to specific info request 6: As previously discussed, in partnership with Fobig- a expert risk characterization consultant – ESTO and CRIP (Crumb Rubber Industry Platform) launched the project Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF) (informally called Fobig study) earlier this year. More than 50 samples of ELT – derived rubber will be collected, including samples of crumb rubber from recycled plants and directly from fields with ELT derived rubber as infill material, from outdoor and indoor facilities. The study will look at the content of other substances suspected to be present in STF beyond PAH, namely metals (such as cobalt or zinc) or benzothiazole s. We expect that the results will confirm current knowledge on the presence and content of other substances in ELT-derived rubber. However, we would recommend to focus the restriction on PAHs, as for the time being, there is insufficient knowledge about the presence of other substances in crumb rubber and their concentration level.
		Dossier submitter response:
530	**Date:** 2017/10/17 22:41 **Type:** BehalfOfAnOrganisation **Org. type:** Industry or trade association	**General comments:** Rubber compound is a complex mixture of many components that undergo further transformations during vulcanisation. The final rubber product contains ingredients that are still not chemically bonded to the base polymer chain. They may appear on the product surface or move over time to the surface of the product (sometimes this is a deliberate phenomenon - the migration of anti-oxidants and anti-aging substances). So we should be careful when saying that rubber components (e.g. PAH's) are permanently bound in rubber. These components are usually hydrophobic, difficult

	Org. name: ETRA **Org. country:** Belgium **Name confidential:** Yes **Attachment:** ref_530_conf.pdf **Privacy statement:** 4(2) Commercial interests, including inteletual property, would be undermined.	to leach into the environment and are therefore a low risk. Mainly contained in oils (plasticisers of rubber compounds) - aromatic hydrocarbons, also containing PAH's, have no particular tendency to be released from the polymer matrix. The relationship between PAH content in rubber and its impact on the external environment, including people in contact with it, is not known. A key criterion defining an acceptable risk should be - supported by additional measurements - a risk scenario for specific uses. The concentration of PAHs in rubber granulate for infill material has been taken into consideration in terms of quantity contained in the rubber but not as an impact on the environment and/or human health. There is no scientific proof that there is a migration of PAHs from the granulate to the environment or human bodies. The preliminary report from ECHA established that : there are no reasons to advise people against playing sports on synthetic turf containing recycled rubber granules as infill material. This advice is based on ECHA's evaluation that there is a very low level of concern from exposure to substances found in the granules. Recycled SBR composition (chemicals included in it) is determined by tire manufacturers. RTMs producers do not have any influence on it. The composition of rubber compounds and ingredients used in tyre manufacture are not published. Restrictions have been imposed by REACH regulations, eliminating hazardous substances. Thus, the concentration of PAHs in rubber granulates is a consequence of the concentration of PAHs used in the production of new tyres. There is already an established trend to reduce PAHs in rubber granulate determined by the reduction of PAHs in tyre production. It is not clear how the PAH concentration in rubber granulate can be further reduced without further reducing the content in manufacture of new tyres. We may seek to minimize the amount of hazardous substances in infill materials, but the level considered safe has not been scientifically determined over time and could be cause for costly and unproductive activities. Limits on chemicals used in plastic and rubber technology are defined under REACH, and most of the dangerous substances seem to have been eliminated or reduced to levels that do not impact negatively upon human health or the environment. It is difficult to demand the reduction of a specific ingredient that appears in a secondary raw material without its prior reduction in the original product (raw material). Any reduction in PAHs in recycled tyre materials (infill) are due to the reductions of ingredient levels used in the 'raw material' (the tyre). It would appear that significant scientific indications must be present in the recycled output if in fact there is a negative impact not tied to a similar issue with the original product. Unverified actions could inadvertently have a negative impact on the Circular Economy goal of increased recycling and reduced reliance upon virgin materials. Thus, it could be inadvisable to make additional reductions not based on verifiable scientific

		evidence which could create fear and reluctance to use these products. People could believe that a reduction was made because the material is dangerous. What would be the option for existing fields whose PAH content does not comply with the new limits? What would be the consequence for the environment and human health from the impact of removal and disposal of "hazardous" fields? And what would be the impact on the tyre recycling industry based upon a hasty decision based upon "uncertainties"? The tyre recycling industry is under pressure and in competition with traditional industries for competitive outputs. Recycled outputs are prized because of their high performance but they are also valued for their cost-effective pricing. The decision to reduce the concentration of PAHs in rubber granulate is premature and based on too many scientific "uncertainties"
		Answer to specific info request 1: See attachment.
		Answer to specific info request 2: See attachment.
		Answer to specific info request 3: See attachment.
		Answer to specific info request 4: See attachment.
		Answer to specific info request 5: See attachment.
		Answer to specific info request 6: See attachment.
		Dossier submitter response:
531	**Date:** 2017/10/18 11:18 **Type:**	**General comments:** The bio-availability is crucial, not the content.

	BehalfOfAnOrganisation **Org. type:** Industry or trade association **Org. name:** wdk - Wirtschaftsverband der deutschen Kautschukindustrie **Org. country:** Germany	**Answer to specific info request 1:** In the application of recyled rubber material (tyres, etc.) it is not the content of PAH and other chemicals that is relevant, but the bio-availability for the consumer or user. Only migration testing and the subsequent risk assessment are an indicator for possible health risk - not an extraction of all components in a sample. The analysis method must be changed and adapted. Alternative methods have been presented in the recent past. **Answer to specific info request 2:** Alternatives with "fresh" material will always use primary ressources, meaning that fossile and natural raw materials must be used to produce new product. This totaly disrespects the idea of circular economy. As stated in point 1) rubber granules are a crucial contribution to circular economy, save natural ressources and present no objective, measurable health risk. **Answer to specific info request 4:** please refer to point 1) and 2) **Answer to specific info request 5:** The circular economy of End-of-Life-Tyres (ELT) and rubber scrap is at risk. Granulators and Recyclers will not be able to fullfil the necessary duty/step in the chain of materials. **Dossier submitter response:**
532	**Date:** 2017/10/18 16:58 **Type:** BehalfOfAnOrganisation **Org. type:** Regional or local authority	**General comments:** We want to submit some information on sampling and analyses of these pitches and the material used. These include PAHs, and other elements (Zn, Hg, Cd, ...). **Answer to specific info request 1:** In the past months the Flemish owners of a synthetic turf pitch infilled with rubber granulate could demand an analysis of the PAH-content of the infill material. SGS performed the sampling and

	Org. name: Flemish Authority - Policy Area Environment **Org. country:** Belgium **Attachment:** ref_532.pdf	analyses. The results were compared with the REACH standards. Recytyre, the Belgian EPR management body for waste tyres, financed the investigations. In total 96 Flemish fields were investigated. The amount of the 8 individual PAH was for all fields at all times below 100 mg/kg. The sum of 18-PAH was always far below 1000 mg/kg. The sum was on average for the 96 fields 53,9 mg/kg. For only one field the sum of 18-PAH exceeded 100 mg/kg (sum was 102,2 mg/kg). The 96 individual reports are available on demand.
		Answer to specific info request 6: Under section IV we attached the VITO study "Analysis of the leaching of synthetic turf pitches" (this document is only available in Dutch). The turf pitch-systems in Flanders typically have an underlayer of sand/lava or an underlayer of limestone battle. Vito investigated in 2013 the leaching behaviour of these two representative synthetic turf pitch-systems. For both systems a 'fresh' and 'deprecated' variant was tested. The elements tested were: As, Cd, Cr, Cu, Ni, Pb, Zn, Hg and also Sb, Ba, Br, Cl, Co, F, Mo, Se, SO4(2-), Sn, V. The study concluded that the amount of zinc released from the pitch is low for both systems and is far below the limit set in VLAREMA (Order of the Government of Flanders adopting the Flemish regulation on the sustainable management of material cycles and waste). The two tested underlayers showed a sorption capacity for zinc. The release of zinc from the pitch itself was also tested: it was five times higher than the zinc-release from the rubber granulate. For the other tested elements also no exceedances were observed. For the deprecated variants some elements (Hg, Ba, F, SO4(2-)) showed an elevation of the leaching in comparison with the fresh material. The measured leaching was however still far below the limits set in VLAREMA for the use of raw materials as building materials.
		Dossier submitter response:
533	**Date:** 2017/10/18 17:28 **Type:** BehalfOfAnOrganisation **Org. type:** Company **Org. name:** TenCate Grass Holding B.V.	**General comments:** Rubber granules for use in artificial turf pitches should be defined as an Article, which allows for more stringent levels of PAH's to be established in an amended ANNEX XVII entry 50 of REACH.
		Answer to specific info request 1: Infill for artificial turf is acquired through third parties. For tyre derived materials we adhere to the Dutch RIVM Safety levels. For non- tyre derived material we demand materials to comply with concentrations of max 0,5 mg/kg PAH's

<table>
<tr><td></td><td>Org. country: Netherlands

Name confidential: Yes

Attachment:
ref_533_conf.pdf

Privacy statement:
The document contains confidential R&D information as well as commercial and personal information.</td><td>Answer to specific info request 2:
see Part 1 of the enclosed document for further reference. the PE based infill we are producing complies with the leaching and compensation of the Dutch Soil Decree (environment) and the requirements Entry 50.6 of Annex XVII of REACH (HEALTH)

Answer to specific info request 3:
PE based infill material; currently 200 tons/year is produced by our company

Answer to specific info request 4:
The requested information on unit pprices is confidential and will not be supplied.
Substitition costs per articifial turf pitch will on average be 60K Euro

Answer to specific info request 5:
Negative: costs will be higher. However, we have noted that major municipalities in the Netherlands have moved from tyre derived material to non-tyre derived material and accepted the higher costs.
Positive: new developments and innovation for non-fill and alternative infill solutions

Answer to specific info request 6:
not available; we refer to ETRMA and specific suppliers of both tyre derived materials and non-tyre derived materials.

Dossier submitter response:</td></tr>
<tr><td>534</td><td>Date: 2017/10/18 18:46

Type:
BehalfOfAnOrganisation

Org. type: Company

Org. name: Celanese So.F.teR

Org. country: Italy</td><td>General comments:
all comments are included in the fields addressing the specific questions.

Answer to specific info request 1:
Italy-based company Celanese So.F.teR. is a global leader in the field of Thermoplastic Elastomer (TPE) granules for the infill of artificial turf. (http://www.softergroup.com/en/artificial_turf_infill ; http://www.tpeinfill.com/). PAH-free infill product made from virgin raw materials is manufactured on industrial scale and represents a sustainable substitution of crumb rubber.
The concentration of PAHs (including the eight specific PAHs governed by REACH Annex XVII (50)) determined for the products for the Celanese So.F.teR. TPE infill materials Terra® XPS, Holo® SP, Holo® GT, and Forgrin® HT140. The sum of Polycyclic aromatic hydrocarbons (PAH) in these</td></tr>
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Privacy statement:
Details on production capacities will be submitted as confidential information. Providing such information publicly would impact Celanese So.F.teR.'s commercial interests since competitors would be made aware of these numbers.</td>
<td>products was determined to be < 0.1 mg/kg, using method ZEK 01.4-08:2011-11.
The analytical reports can be made available if deemed necessary by ECHA.</td>
</tr>
<tr>
<td>Answer to specific info request 2:
Detailed comments on this question are submitted as a non-confidential attachment (file name " Infill Granules Synthetic turf - Q 2- Celanese 2017-10-18.pdf"), because the webform does not allow the transmission of suitably formatted text.
Summary
While we cannot directly compare Celanese So.F.teR's Thermoplastic Elastomer (TPE) granules to other materials, we can provide detailed information on our products' properties, allowing a later comparison with PAH-containing materials by the regulators.
Celanese So.F.teR. manufactures Thermoplastic Elastomer (TPE) granules for the infill of Artificial Turf (AT) systems for both indoor and outdoor use in different climate zones. PAH-free infill product made from virgin raw materials is manufactured on industrial scale and represents a sustainable substitution of crumb rubber.
Properties of Celanese PAH-free Thermoplastic Elastomer (TPE) granules:
All Celanese So.F.teR. TPE infill materials have been designed to deliver high level sports performance, while complying with stringent environmental and consumer product requirements, for example by being compliant with the Dutch Soil Quality Decree requirements and the requirements of REACH Annex XVII.
Components in Artificial Turf (AT) systems and their impact on Cost and Maintenance:
AT systems generally consist of artificial turf fibers, infill granules, sand infill, carpet backing, and sub-base. The systems differ in the presence of the so-called shock pad. They also differ remarkably in the necessary volumes of materials to install the sports field, as well as potentially in the type of infill material (crumb rubber vs. TPE performance infill). The detailed comments in the attachment include exemplary images of AT turf systems.
Cost of Ownership Considerations:
Comparison of a Styrene Butadiene Rubber (SBR; from End of Life Tires (ELT)) system with a Thermoplastic Elastomer (TPE) infill systems provides information on initial installation cost and Follow-up costs during installation's life cycle.</td>
</tr>
<tr>
<td>Answer to specific info request 3:
Details on production capacities will be submitted as confidential information. Providing such information publicly would impact Celanese So.F.teR.'s commercial interests since competitors would be made aware of these numbers.</td>
</tr>
</table>

		Answer to specific info request 5: In case the restriction on PAHs in granules results in a higher demand for Celanese So.F.teR's TPE performance infill manufactured from PAH-free, virgin thermoplastic elastomer, this could result in investments into equipment and the generation of a small number of additional jobs at our Italian site.
		Answer to specific info request 6: Detailed comments on this question are submitted as a non-confidential attachment (file name "Infill Granules Synthetic turf - Q 6 - Celanese 2017-10-18.pdf"), because the webform does not allow the transmission of suitably formatted text. Summary Considering the exposure paths and duration to infill granules at sports activities, it is critical that such infill materials do not pose a risk to human health and the environment. For this reason, Celanese So.F.teR's TPE performance infill portfolio is manufactured from PAH-free, virgin thermoplastic elastomer and components which are provided by qualified, regularly audited suppliers. The Celanese So.F.teR. TPE infill materials can be considered as safe for the environment since they are proven to comply with the stringent requirements established by the Dutch Besluit bodemkwaliteit (Soil Quality Decree). After being successfully audited by the accredited test institute SGS Intron B.V., Celanese So.F.teR. as a manufacturer of TPE infill material is entitled to provide the Manufacturer's declaration (Fabrikant-eigenverklaring). The Celanese So.F.teR. TPE infill materials were tested by the accredited laboratory and found to comply with all parameters established by the Soil Quality Decree. • All organic content, including concentration of PAHs, is below analytical detection limit. • Emission or leaching of zinc was determined to be below detection limit; only one metal was detected at all, in a concentration way below the limit value. The concentration of PAHs (including the eight specific PAHs governed by REACH Annex XVII (50)) in several TPE infill materials was determined in an additional, independent analysis for the products Terra® XPS, Holo® SP, Holo® GT, and Forgrin® HT140. The sum of Polycyclic aromatic hydrocarbons (PAH) was determined to be < 0.1 mg/kg, using method ZEK 01.4-08:2011-11.
		Dossier submitter response:
535	**Date:** 2017/10/18 20:30 **Type:**	**General comments:** See attached letter of today

	BehalfOfAnOrganisation **Org. type:** Company **Org. name:** Conradi+Kaiser GmbH and Kraiburg Relastec GmbH & Co. KG **Org. country:** Germany **Attachment:** ref_535.pdf	**Dossier submitter response:**
536	**Date:** 2017/10/18 21:53 **Type:** BehalfOfAnOrganisation **Org. type:** Other contributor **Org. name:** Lega Nazionale Gioco Calcio **Org. country:** Italy **Attachment:** ref_536.zip	**General comments:** The Federazione Nazionale Gioco Calcio (FNGC) is really interested on the process as it manage most of the synthetic pitches in Italy, used for playing football, the most popular sport in Italy. This type of pitches are wide spread all over the Italian country. People exposed to toxic compound eventually present may belong for a minimal part to professional football player. Most of the users belong to the general public of all ages, from children to adult. For this reason the LNGC is really interested in the safety of the material used as infill material in synthetic pitches and will be glad to give other contributions also in the future since alternative materials have been evaluated for this purpose. Unfortunately actually reliable results are not ready and complete for been introduced inside this call. **Answer to specific info request 1:** Two samples of rubber granulates used as infill material in synthetic turf pitches were collected from two different real football playgrounds. The amount of Benzo[b]fluoranthene and Benzo[e]pyrene] exceed the value of 1 mg/kg on the sample G while the content of each PAH in the sample D is lower that 1mg/kg. The analytical method used for quantification was ISTISAN 16/13. The english translation of the method was attached. The performances of the method were tested during a Proficiency test, giving good Z-score values. In addition the method was compared with the ISO 21461: 2012 applying both methods to the same rubber samples. Three national

		laboratories partecipated to the method development and the evaluation of its performance.
		Dossier submitter response:
537	**Date:** 2017/10/18 23:50 **Type:** BehalfOfAnOrganisation **Org. type:** Regional or local authority **Org. name:** City of Stockholm, Environmental and health administration **Org. country:** Sweden **Attachment:** ref_537_conf.zip	**General comments:** Chemical analysis of 9 substance groups plus headspace volatiles (aliphatic and aromatic hydrocarbons) (see attached file) in 5 virgin EPDM rubber (4 used top layer in poured in place rubber on playgropunds, 1 used as infill in artificial turf). The same substance groups were analysed in recycled SBR rubber for use as base layer in poured in place rubber at playgrounds. Samples was distributed direct from producers.
		Answer to specific info request 1: See attached files.
		Answer to specific info request 2: In our investigation several substances were analysed, but there are probaly more substances that we do not know anything about. PAH's (as is CMR substances) were quantified in one sample of EPDM. Zink (oxide) is quatified in high concentration and is a suspected endocrine disruptor. Also lead and coboltare hazardous substances. There are not sufficient information about substances in rubbergranule and therefore very difficult to make proper risk assessmant. According to scientific references, there are Ecotoxicological effect´s of some EPDM, especially R-EPDM (recycled). Some suspicion about difference in generation microplastics between different types of rubber according to density, weight etc.
		Answer to specific info request 6: See the attached files.
		Dossier submitter response:

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

Austrian data collection on PAH in plastic and rubber products measured by the Environment Agency Austria (Umweltbundesamt)

Substance name: Benzo[a]pyrene (BaP); Benzo[e]pyrene (BeP); Benzo[a]anthracene (BaA); Chrysene; Benzo[b]fluoranthene (BbFA); Benzo[j]fluoranthene (BjFA); Benzo[k]fluoranthene (BkFA); Dibenzo[a,h]anthracene (DBAhA)

CAS Number: 50-32-8; 63466-71-7; 192-97-2; 56-55-3; 1718-53-2; 218-01-9; 1719-03-5; 205-99-2; 205-82-3; 207-08-9; 53-70-3

	Number of samples											
Substance Name	**total**	**n.d.**	**< LOQ**	**> LOQ**	**Min.**	**Max.**	**LOQ**	**LOD**	**Unit**	**Order Number**	**Year**	**Matrix**
Benzo(a)anthracene	11	7	1	3	0.33	1.8	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Benzo(a)pyrene	11	6	3	2	0.71	1.5	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Benzo(b)fluoranthene	11	9	1	1	0.63	0.63	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Benzo(e)pyren	11	8	1	2	0.87	1	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Benzo(j)fluoranthene	11	10	1	0	n.d.	<0.2	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Benzo(k)fluoranthene	11	10	1	0	n.d.	<0.2	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Chrysen	11	8	0	3	0.36	3	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor
Dibenzo(a,h)anthracene	11	11	0	0	n.d.	n.d.	0.2	0.1	mg/kg	A 13960	2015	rubber mat/floor

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

	Number of samples											
Substance Name	total	n.d.	< LOQ	> LOQ	Min.	Max.	LOQ	LOD	Unit	Order Number	Year	Matrix
Benzo(a)anthracene	9	7	0	2	0.29	0.4	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Benzo(a)pyrene	9	8	0	1	0.31	0.31	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Benzo(b)fluoranthene	9	6	1	2	0.62	0.68	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Benzo(e)pyren	9	8	1	0	n.d.	<0.2	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Benzo(j)fluoranthene	9	7	1	1	0.44	0.44	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Benzo(k)fluoranthene	9	9	0	0	n.d.	n.d.	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Chrysen	9	8	1	0	n.d.	<0.2	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)
Dibenzo(a,h)anthracene	9	9	0	0	n.d.	n.d.	0.2	0.1	mg/kg	A 13960	2015	rubber mat (fitness, yoga)

	Number of samples											
Substance Name	total	n.d.	< LOQ	> LOQ	Min.	Max.	LOQ	LOD	Unit	Order Number	Year	Matrix
Benzo(a)anthracene	10	2	1	7	0.63	1.6	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Benzo(a)pyrene	10	2	0	8	0.45	2.3	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Benzo(b)fluoranthene	10	2	0	8	0.31	2.2	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Benzo(e)pyren	10	2	0	8	0.052	4.6	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Benzo(j)fluoranthene	10	2	1	7	0.22	0.55	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Benzo(k)fluoranthene	10	4	1	5	0.23	0.43	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Chrysen	10	2	0	8	0.086	2.5	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor
Dibenzo(a,h)anthracene	10	9	1	0	0.23	0.23	0.2	0.1	mg/kg	A 14686	2017	rubber mat/floor

	Number of samples											
Substance Name	total	n.d.	< LOQ	> LOQ	Min.	Max.	LOQ	LOD	Unit	Order Number	Year	Matrix
Benzo(a)anthracenee	4	0	1	3	0.054	1.4	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Benzo(a)pyrene	4	0	2	2	1.4	2.1	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Benzo(b)fluoranthene	4	0	2	2	1.4	1.7	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Benzo(e)pyren	4	0	1	3	0.052	3.4	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

	Number of samples											
Substance Name	total	n.d.	< LOQ	> LOQ	Min.	Max.	LOQ	LOD	Unit	Order Number	Year	Matrix
Benzo(j)fluoranthene	4	0	2	2	0.35	0.4	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Benzo(k)fluoranthene	4	0	2	2	0.29	0.43	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Chrysen	4	0	1	3	0.086	2.5	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf
Dibenzo(a,h)anthracene	4	1	2	1	0.23	0.23	0.2	0.1	mg/kg	A 14686	2017	rubber mat with synthetic turf

LOD = Limit of detection
LOQ = Limit of quantification
n.d. = not detected

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Kimrök	1333-86-4		Fyllmedel	x		x	x	x						Ej påbörjad				2							3	1	1			2	2	1	4		2				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.014.191)
Diamin, N-(1,3-dimetylbutyl-)N'-fenyl-p-fenylen-(6PPD)	793-24-8	Bensenediamin	Additiv, åldringsskydd, antioxidant	x	x			x													1				3	2	1	1		2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.011.222)
Diamin, Di-(dimetylpentyl)-p-fenylen-	3081-14-9			x				x						Pågående		Misstänkt PBT/vPvB					1						1	1					3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.019.433)
Diamin, N-(1,4-dimethylpentyl)-N'-phenylbenzene-1,4- (7PPD)	3081-01-4	Bensenediamin	Åldringsskydd		x			x						Pågående, ytterligare information begärd		Misstänkt PBT/vPvB					1						1	1			2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.019.432)
1,2-Dihydro-2,2,4-trimethylquinoline, oligomers (TMQ)	26780-96-1		Additiv, åldringsskydd	x				x													1 A						2	1					4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.105.558)
1,4-Benzenediamine, N,N'-	68953-84-4	Bensenediamin	Additiv, åldringsskydd	x				x						Pågående		Misstänkt					1 B	1					1	1		2									Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Beeränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
mixed Phenyl and tolyl derivs. (Diaryl, PPD)																PBT/vPvB																							information/-/substanceinfo/100.066.551)
Stearinsyra	57-11-4			x				x																	3		3			2	2		4		1	1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.285)
Amid, Cyklohexyl-bensotiazyl-sulfen- (CBS)	95-33-0	Bensotiazol	Additiv, Accelerator	x				x	x												1						1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.193)
Amid, N-tert-butylbenzothiazole-2-sulphen- (TBBS)	95-31-8	Bensotiazol		x				x													1						1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.191)
Di(benzothiazol-2-yl)-disulphide (MBTS)	120-78-5	Bensotiazol	Accelerator	x				x	x												1						1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.004.023)
Naftalen	91-20-3	PAH	Lösningsmedel	x		x		x	x					Pågående (hög RCR-risk)				2									1	1					4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.863)
Acenaftylen	208-96-8	PAH		x				x																	3					2	2		1						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.380)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens.. kan orsaka allergi	Resp. Sens.. kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Acenaften	83-32-9	PAH		x				x																	3		1	1		2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.336)
Fluoren	86-73-7	PAH		x				x																	3		1	1		2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.541)
Fenantren	85-01-8	PAH		x		x	x	x										2			1				3		1	1		2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.437)
Antracen	120-12-7	PAH		x				x		x	x					PBT		2			1				3		1	1		2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.974)
Fluoranten	206-44-0	PAH		x				x							Uppskjuten PACT-utvärdering	Misstänkt PBT/vPvB											1	1		2			4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.376)
Pyren	129-00-0	PAH		x				x																	3		1	1		2	2		2						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.004.481)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Bens(a)antracen	56-55-3	PAH		x				x	x	x			x				x	1B									1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.255), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Krysen	218-01-9	PAH		x				x	x	x			x				x	1B	2								1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.386), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Bens(b)fluoranten	205-99-2	PAH		x				x	x	x			x				x	1B									1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.375), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Bens(k)fluoranten	207-08-9	PAH		x				x	x	x			x				x	1 B									1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.379), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Bens(a)pyren (BaP)	50-32-8	PAH		x				x	x	x			x		Pågående PACT-värdering		x	1 B	1 B	1 B	1						1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.026), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Dibens(ah)antracen	53-70-3	PAH		x				x	x	x			x				x	1 B									1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.166), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Benso(ghi)perylen	191-24-2	PAH		x				x																			1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.350)
Indeno(123cd)pyren	193-39-5	PAH		x				x										2																					Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.359)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (mtillverkad termoplast)	EPDM (mtillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Beeränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Arsenik, As	7440-38-2	Metall			x	x	x	x	x	x			x (Inga begränsningar mot användning i däcktillverkning.)														1	1					3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.316), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Bly, Pb	7439-92-1	Metall			x	x	x	x		x			x			PBT	x	2	2	1 A					2	1	1	1					3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.273), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Kadmium, Cd	7440-43-9	Metall			x	x	x	x	x	x	x		x				x	1B	2	2						1	1	1					2						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.320, Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Kobolt, Co	7440-48-4	Metall			x			x	x												1	1					4												Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-

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Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Beeränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
																																							information/- /substanceinfo/100.028.325)
Koppar, Cu	7440-50-8	Metall			x			x													1				2	1	1	1		2	2		2		1				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/- /substanceinfo/100.028.326)
Krom, Cr	7440-47-3	Metall			x	x	x	x									x	1 B	2		1	1			2	2	1	1		2	2				1				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/- /substanceinfo/100.028.324)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Kvicksilver, Hg	7439-97-6	Metall			x	x	x	x	x	x			x (Inga begränsningar mot användning i däcktillverkning.)				x			1B						1	1	1					2						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.278), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens.. kan orsaka allergi	Resp. Sens.. kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Nickel, Ni	7440-02-0	Metall			x			x		x			x (Inga begränsningar mot användning i däcktillverkning.)				x	1 A			1	1				1													Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.283), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Selen, Se	7782-49-2	Metall			x			x	x																	2	4						3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.029.052)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Zink, Zn	7440-66-6	Metall			x	x	x	x	x														1	1			1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.341)
Vanadin, V	7440-62-2	Metall			x			x																			4												Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.337)
Fluorid	7664-39-3 (fluoridjon)	Salter			x			x	x																								1			1 A			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.759)
Sulfat	14808-79-8 (sulfatjon)	Salter			x	x	x																																Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=14808-79-8)
Oktylfenol	67554-50-1	fenol			x	x	x	x																				1	1		2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.060.634)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrieummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Nonylfenol	25154-52-3	fenol			x	x	x	x	x	x			x (Inga begränsningar mot användning i däcktillverkning.)							2							1	1					4			1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.042.414), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

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Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Dietyl-hexyl-ftalat (DEHP)	117-81-7	Ftalat	Mjukgörare.	x	x	x	x	x	x	x	x	x	x (Inga begränsningar mot användning i däcktillverkning.)				x			1B																			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.829), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Dibutylftalat (DBP) (Di-n-butylftalat)	84-74-2	Ftalat	Mjukgörare.		x	x	x	x	x	x	x	x	x (Inga begränsningar mot användning i däcktillverkning.)			T	x			1 B								1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.416), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Dietylftalat (DEP)	84-66-2	Ftalat			x	x	x	x												2	1				3	2	1			2	2		1						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.409)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Di(isononyl)ftalat (DINP)	28553-12-0	Ftalat			x			x		x			x (Inga begränsningar mot användning i däcktillverkning.)															1					4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.044.602, Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Benzen	71-43-2	VOC			x			x	x	x			x (Inga begränsningar mot användning i däcktillverkning. Får inte släppas ut på marknaden som ämne, som beståndsdel i andra ämnen eller i blandningar i koncentrationer på 0,1 viktprocent eller högre.)				x	1 A	1 B							1				2	2			1	2				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.685, Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Benzen, isocyanato-	103-71-9	VOC			x			x										2			1 A	1			3		2	1	1				1		3	1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
																																							information/- /substanceinfo/100.002.852)
Cyclohexan	110-82-7	VOC			x			x	x	x			x (Inga begränsningar mot användning i däcktillverkning.)			PBT enligt ämnets InfoCard. Ej PBT enligt Registration dossier.									3		1	1			2			1	2				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.461), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)

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Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Cyclohexan, isocyanato-	3173-53-3	VOC			x			x													1 A	1			3					2	2		1		3	1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.019.673)
Benso(a)fluoranten	203-33-8	PAH			x																																		Sweco 2015, Kemls ämnesregister, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=203-33-8 (Hämtat feb. 2016))
Cyclohexamin	108-91-8 (ECHA, *cyclohexanamine*) eller 2201-15-2(Kemls ämnesregister, *cyclohexamine*). Egenskaper och begränsningar gäller för 108-91-8.				x			x	x					Ej påbörjad						2													4		3	1 B			Sweco 2015, Kemls ämnesregister, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.300)
Fenol, 2,4-Di-tert-butyl-	96-76-4	fenol			x	x		x						Ej påbörjad (misstänkt CMR)											2	2	1	1	1	2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.303)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Diisobutylftalat (DIBP)	84-69-5	Ftalat	Mjukgörare.		x	x	x	x	x	x	x	x	x (Inga närmare uppgifter hitttades .)			PBT	x			1 B																			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.412), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Butylerad hydroxytoluen	128-37-0				x			x										2		2	1				1	2	1	1		2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.004.439)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrieummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
D-limonen	5989-27-5 (ECHA) eller 8028-48-6 (ECHA). Egenskaperna gäller för 5989-27-5		Doftämne		x			x	JA (5989-27-5), NEJ (8028-48-6)												1						1	1			2				3				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.025.284)
Hexanon, 5-Methyl-2-	110-12-3				x			x	x																								4		3				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.399)
Cyklohexanon	108-94-1				x			x	x					Pågående																			4		3				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.302)
Benzaldehyd/ Benzaldehyd	100-52-7				x	x		x	x																								4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.601)
Benzaldehyd, 2-hydroxy-	90-02-8				x			x											2						2	2	2			2	2		3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.783)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Hexansyra	142-62-1				x			x																					1				3			1 A	1		Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.046)
Hexansyra, 2-etyl-	149-57-5				x			x	x					Pågående (misstänkt CMR-ämne), ytterligare information begärd						2																			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.222)
Etanol	64-17-5				x			x	x																										2				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.526)
Etanol, 1-(2-butoxyethoxy)-	54446-78-5				x																																		Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=54446-78-5 (hämtat feb. 2016))
N-cyclohexyl-formamid	766-93-8				x			x																	3				1		2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.162.714)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Acetamid	60-35-5				x			x	x									2																					Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.000.430)
Acetamid, N-cyclohexyl-	1124-53-4				x			x																															Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.013.090)
Fenol	108-95-2				x	x		x	x					Pågående					2							2							3			1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.003.303)
Fenol, m-tert-butyl-	585-34-2				x	x		x																			2		1							1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.008.687)
Cyclohexanamin, N-cyclohexyl-	101-83-7				x			x	x																		1	1					4			1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.710)
Cyclohexanamin, N-cyclohexyl-N-methyl-	7560-83-0				x			x																					1				3			1 B			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.595)
Dodekansyra	143-07-7				x	x		x													1				3 (no		2		1	2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
																									da ta)														information/- /substanceinfo/100.005.075)
Benzotiasolon (Benzothiazol -2(3H)-one)	934-34-9				x			x																									4						Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.012.074)
Benzaldehyd, 3,5-Di-tert-Butyl-4-hydroxy-	1620-98-0				x	x		x																	3					2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.015.084)
1,3-Dicyclohexylu rea	2387-23-7				x			x																									4						Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.017.468)
Diamine, N-isopropyl-N'-phenyl-p-phenylene-(IPPD)	101-72-4				x			x	x												1						1	1					4						Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.002.700)
Melamin, Hexa(methox ymethyl)-	3089-11-0				x			x										2			1									2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.019.475)
Anilin	62-53-3				x			x	x									2	2		1					1		1	1				3						Sweco 2015, ECHA (http://www.echa.europa.eu/w eb/guest/substance-information/- /substanceinfo/100.000.491)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Polyuretan	64060-31-7 (polyuretan), 68400-67-9 (polyuretan gummi), 68083-75-0 (polyurethane prepolymer), 9018-04-6 (polyurethane resin). Egenskaper gäller för 68083-75-0 och 9018-04-6		Täcknings medel	x				x													1	1			3	2	2			2	2		4						Sweco 2015, Kemis ämnesregister, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.158.594 och http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.121.989)
Naturgummi	9006-04-6						x	x													1	1			3				1		2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.029.705)
Krita	471-34-1		Fyllmedel				x	x																	3	1			1	2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.006.765)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Silika (silicon dioxide)	7631-86-9, 112926-00-8 (ECHA, dubbla CAS-no.)		Fyllmedel				x	x						Pågående, ytterligare information begärd											1	1	3			2	2		4	1					Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.678)
Talk	14807-96-6		Fyllmedel				x	x									x	1 A							3	1	4			2			4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.035.328)
Kaolin	1332-58-7		Fyllmedel				x	x									x	1 A				1			1	1				2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.100.108)
Aluminiumtrihydrat	13473-90-0		Flamskyddsmedel				x	x																	1				1	2	2		3					1, 2	Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.033.396)
Magnesiumkarbonater	546-93-0 (magnesiumkarbonat)		Flamskyddsmedel				x	x																						2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.008.106)
Klorparaffiner	85535-84-8 (chlorinated paraffins)		Flamskyddsmedel				x	x	x	x	x					PBT		2									1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.079.496)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassificering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Ftalat, Butylbenzyl- (BBP)	85-68-7	Ftalat	Mjukgörare. Förekommer i naturgummi.	x		x	x	x	x	x	x	x	x (Inga begränsningar mot användning i däcktillverkning.)				x			1 B							1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.475), Annex XVII (http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02006R1907-20150925&qid=1447934128574&from=SV)
Ftalat, Dicyclohexyl- (DCHP)	84-61-7	Ftalat	Mjukgörare.			x	x	x							SVHC-kandidat	T	x			1 B	1				3		3			2	2								Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.001.405)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Paraffinolja	8012-95-1 (paraffin oils)		Mjukgörare			x	x	x											2			1			2	1	1	1		2	2			1	3				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.029.438)
Tenn, Sn	7440-31-5		Metall			x	x	x														1			3	1	4			2	2		4		1				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.028.310)
Benzen, à,à'-Dihydroxy-m-diisopropyl-	1999-85-5						x	x																	3					2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.016.261)
Ethanon, 1,1'-(1,4-phenylen)bis-	1009-61-6						x	x																															Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.012.518)
Ethanon, 1-[3-(1-hydroxy-1-methylethyl)phenyl]-	54549-72-3						x																																Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=54549-72-3)
Ethanon, 1-[4-(1-methylethenyl)phenyl]-	5359-04-6						x																																Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=5359-04-6)
Acetofenon	98-86-2					x	x	x	x																					2			4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.462)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
SEBS (Styren-Butadien-polymer)	66070-58-4 (hydrogenated styrene/butadiene copolymer)	Plast. Blandning, kan innehålla andra ämnen (Magnusson 2015)				x		x																			4						4		2				Sweco 2015, Magnusson 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.116.378)
Polypropen	9003-07-0	Plast				x		x																											2				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.117.813)
Fosfiter	14901-63-4 (phosphite)		Processtabilisatorer			x																																	Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=14901-63-4)
Bis-(2,2,6,6-tetramethyl-4-piperidinyl)-sebacate	52829-07-9		UV-skydd			x		x																	3		1	1	1	2	2		2			1 C			Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.052.899)
Benzophenon, 2-hydroxy-4-(octyloxy)-(Octabenzon)	1843-05-6					x		x						Pågående, ytterligare information begärd							1						1			2	2				3				Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.015.838)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Fenol, 2-(2H-Benzotriazol-2-yl)-4-methyl-	2440-22-4					x		x						Ej påbörjad		P, vP					1					2 (no data)	1			2			1						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.017.700)
Cresol, 2-(5-Chloro-2-benzotriazolyl)-6-tert-butyl-p-	3896-11-5					x		x																	3		3			2	2		4						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.021.315)
Fenol, 2-(5-chloro-2Hbenzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl)- *eller likn.*	3864-99-1					x		x		x	x					vPvB									2	2	1	1		2	2		3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.021.259)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
2-mercaptobenzothiazole	149-30-4				Är en nedbrytningsprodukt av CBS och TBBS, som förekommer i SBR	x		x	x					Avslutad (*Need for Restrictions, Need for other Community-wide measures*)							1						1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.005.216)
Klorid	16887-00-6 (kloridjon)	Salter				x																																	Sweco 2015, EPA (http://actor.epa.gov/actor/GenericChemical?casrn=16887-00-6)

Ämne (Namn, Akronym)	CAS-nummer	Ämnesgrupp	Användningsområde	SBR	SBR (vid laktest)	TPE (nytillverkad termoplast)	EPDM (nytillverkat vulkaniserat industrigummi)	Registered substance under REACH	Harmoniserad klassifiering i ECHA	Begränsad	Candidate list REACH (SVHC)	Authorisation Annex XIV in REACH	Restriction Annex XVII in REACH	CoRAP-utvärdering	Andra utvärderingar/ pågående arbete	PBT	CMR-ämne	Carc.	Muta.	Repr.	Skin sens., kan orsaka allergi	Resp. Sens., kan orsaka allergi/astma	Pyr. Sol. (spontan antändning vid kontakt med	Water-react.	STOT SE, orsakar skada på inre organ.	STOT RE, orsakar skada på inre organ under	Aquatic Chronic	Aquatic Acute	Eye Dam.	Eye irrit.	Skin irrit.	Self-heat.	Acute tox.	Asp. Tox.	Flam. Sol. / Flam. Liq.	Skin Corr.	Met. Corr.	Ox. Sol./Ox. Liq.	Källor
Bensotiazol	95-16-9	VOC. Risk för allergi för känsliga individer			x	x		x																		2				2			3						Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.002.179)
Zinkoxid	1314-13-2	Metallförening			x		x	x	x					Ej påbörjad													1	1											Sweco 2015, ECHA (http://www.echa.europa.eu/web/guest/substance-information/-/substanceinfo/100.013.839)

Weigeringsgrond 10.2.e

Doc. 20.e.1

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To whom it may concern

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Date
October 16, 2017
Subject
Risk assessment PAHs in rubbergranulates

To whom it may concern,

Via this letter I would like to point out a number of shortcomings and flaws by the RIVM and ECHA in the risk assessments of rubber granulates used on synthetic sport turf fields.

A major criticism is the lack of an additional safety/uncertainty factor for children playing on these fields. From a toxicological point of view, it is very essential to differentiate the risk for carcinogenicity of PAHs between children and adults. Tumor initiation by these compounds is caused by DNA damage and it very plausible that fast dividing cells are more vulnerable for genotoxic compounds. Animal studies have clearly shown that exposure to genotoxic compounds in an early life phase can initiate a 5 to 60 times higher sensitivity for tumor formation later in adult life. This is no speculation but supported by multiple results from toxicological studies and fully justifies the inclusion of an additional safety factor for children (and possible adolescents).[1, 2] Both the EU and the US-EPA have earlier proposed such additional safety (uncertainty) factors for children and genotoxic compounds.[3, 4] The US-EPA has proposed an additional safety factor 10 for children up to 2 years and a factor 3 for children between 2 and 16 years.[3] However, the report describing the proposed factor 3 does not provide any scientific (toxicological) rationale to differentiate between a factor 10 and 3 for this early life time exposure. Actually, the proposed factor 3 for children between and 2 and 16 years has arbitrarily been chosen based on the logarithmic average between an uncertainty factor 1 and 10.[3] Furthermore, it is noticeable that within the EU a similar advice for the need of such an additional safety factor has already been given by three scientific committees in 2009.[4] Nevertheless, no inclusion of such an additional safety/uncertainty factor in the chemical risk assessment for genotoxic compounds has yet been applied within the EU.

Another significant scientific shortcoming in the risk assessment of ECHA is the conclusion that the underlying carcinogenicity study with mice presents a suitable model for children of four years and older.[5, 6] This conclusion is based on the comparative time period from birth to adolescence between mice and humans based on life expectancy. In the ECHA report it is stated that 40 human days are equivalent to 1 mouse day. However, if ECHA would have used the cited article correctly, a conversion factor of approx. 100 human days equivalent to 1 mouse day in the prepubertal phase should have been used.[7]

The consequence of this methodological flaw is the fact that the ECHA risk assessment for PAHs is not valid for children older than 4 years, but actually older than approximately 10 years.

Finally, it should be noticed that the ECHA and RIVM risk assessments do not pay sufficient attention to mixture toxicity. Admittedly, it is extremely difficult to quantitatively establish an additional uncertainty factor for mixture toxicity. Nevertheless, it must be recognized that rubber granulates contain a wide array of compounds with carcinogenic and endocrine disrupting properties, e.g. PAHs, phthalates and BPA. If we restrict this to only the carcinogenic potential of PAHs in rubber granulates, there are clear toxicological arguments that warrant concern. For example, compounds like BPA are also immune disruptors that can modulate the immune system, e.g. via inflammatory processes. Via this mechanism the carcinogenic potential of other compounds like PAHs can be exacerbated. Unfortunately, this example alone already illustrates that the recent risk assessments of RIVM of BPA for rubber granulates did not include the most recent toxicological insights on chemical mixtures.[8]

Based on the information provided above, I conclude that both the RIVM and ECHA risk assessments of PAHs in rubber granulates on articifical playing fields include some serious flaws that creates an underestimation of the risk for children. This should be corrected to obtain a more scientific sound and balanced opinion for children with respect to carcinogenicity of PAHs in rubbergranulates on synthetic sport turf fields.

Yours sincerely,

[redacted]

Prof. dr. dr. *h.c.* Martin van den Berg, ERT
Head Toxicology & Veterinary Pharmacology Division

Universiteit Utrecht

References

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2. Hattis, D., et al., *Age-related differences in susceptibility to carcinogenesis: a quantitative analysis of empirical animal bioassay data.* Environ Health Perspect, 2004. **112**(11): p. 1152-8.
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4. SCHER, *Risk assessment methodologies and approaches for genotoxic and carcinogenic substances*, SCHER, Editor. 2009, European Commission Health & Consumer Protection DG Directorate C: Public Health and Risk Assessment.
5. Culp, S.J., et al., *A comparison of the tumors induced by coal tar and benzo[a]pyrene in a 2-year bioassay.* Carcinogenesis, 1998. **19**(1): p. 117-24.
6. ECHA, *An evaluation of the possible health risks of recycled rubber granules used as infill in sythetic turf sports fields.* 2017, European Chemicals Agency (ECHA): Helsinki, Finland. p. 72.
7. Dutta , S. and P. Sengupta, *Men and mice: Relating their ages.* Life Sciences, 2016. **152**: p. 244-248.
8. Jochmanova, I., et al., *Environmental estrogen bisphenol A and autoimmunity.* Lupus, 2015. **24**(4-5): p. 392-9.

List of Attachments mentioned in this answer to the ECHA Call

01 - Cryoflex DC-0814 - PAH compliance TUV test, 28.07.2006

02 - Cryoflex DC-1430 - PAH compliance TUV test, 28.07.2006

03 - 2017-05-25 PAHs test results of Cryoflex DC-0725

04 - 2017-05-25 PAHs test results of Cryoflex DC-0814

05 - 2017-05-25 PAHs test results of Cryoflex DC-1014

06 - 2017-05-25 PAHs test results of Cryoflex DC-1430

07 - 2013-02-18 NMR - Cryogenic rubber infill - ISO 21461 Determination of the aromacity of oil

08 - Cryoflex Manual - presentation of the technical characteristics of RECIPNEU cryogenic rubber infill

09 - Cryoflex DC-0814 - DIN V 18035-7 Compliance TUV test - Dr. Grunder, 26 April 2008

10 - Cryoflex DC-1430 - DIN V 18035-7 Compliance TUV test - Dr. Grunder, 26 April 2008

11 - 2015-02-11 Cryoflex DC-0725 - LABOSPORT - final test report

12 - Cryogenic Rubber Infill - AMI Conference Grass Yarn and Tufters Forum 2006, Dusseldorf

13 - Rubber Infill - Inhalable Dusts Content (PM2.5 and PM10)

14 - Study of shape of cryogenic and ambient rubber infill granulates - 21 Nov 2013

15 - Cryoflex - Study on Compaction and Friction - TNO and TenCate - April 2008

16 - 2013-08-20 PRODUCT INFORMATION - Cryoflex DC-1430 - nominal size 0,6-1,4 mm

17 - FICHE TECHNIQUE SBR CRYOGÉNIQUE Cryoflex DC-0814 - Novembre 2011

18 - ENVIRONMENTAL AND HEALTH RISK STUDY comparing different infill materials (Tyre Rubber granulates, TPE granules, and EPDM granules) – CEN TC 217 'Env. Task Force', 2007

19 - 2017-10-06 RECIPNEU - Cryoflex produced and supplied for infilling synthetic turf sports fields

20 - 2015-11-06 VACO, RecyBEM - Position paper on PAH restriction for rubber infill

21 - Examination on E.L.T. granulates, 2016-12-20, ICTPOL – IST

Produktsicherheit und -qualität
Produkt- und Umweltanalytik

TÜV

TÜV Rheinland Group

Test Report No.:	AZ 20804b
Date:	28.07.2006
Method:	According to: Determination of 16 polycyclic aromatic hydrocarbons PAH (EPA) in polymers by GC/MS, deviation extraction by toluene; DIN ISO 18287 QMA 2.516.258
Requirement:	Recommended limits according to expert discussion, Berlin, 02.08.2005

Parameter	intended use, skin contact less than 30 sec [mg/kg]	intended use, skin contact more than 30 sec [mg/kg]
Benzo[a]pyren	<20	<1
sum 16 PAH (EPA)	<200	<10

Sample No.:	2006-29038	
Sample:	DC-0814	
Parameter	Unit	Result
Naphthalene	mg/kg	1,4
Acenaphthylene	mg/kg	1,2
Acenaphthene	mg/kg	<0,1
Fluorene	mg/kg	0,4
Phenanthrene	mg/kg	4,3
Anthracene	mg/kg	0,6
Fluoranthene	mg/kg	7,7
Pyrene	mg/kg	22,2
Benzo(a)anthracene	mg/kg	0,5
Chrysene	mg/kg	3,0
Benzo(b)fluoranthene	mg/kg	2,3
Benzo(k)fluoranthene	mg/kg	0,7
Benzo(a)pyrene	mg/kg	2,3
Indeno(1,2,3-cd)pyrene	mg/kg	0,6
Dibenz(a)anthracene	mg/kg	0,2
Benzo(ghi)perylene	mg/kg	4,6
Total PAH (EPA)	mg/kg	52,0

Determination limit of the test method: < 0.1 mg/kg per PAH component.

Single components with an amount of < 0,1 mg/kg were not considered by the calculation of the sum. In the case of all 16 PAH according to EPA were not detected, the result is stated n.n.

-END-

Produktsicherheit und -qualität
Produkt- und Umweltanalytik

Test Report No.: AZ 20804a
Date: 28.07.2006
Method: According to: Determination of 16 polycyclic aromatic hydrocarbons PAH (EPA) in polymers by GC/MS, deviation extraction by toluene; DIN ISO 18287 QMA 2.516.258

Requirement: Recommended limits according to expert discussion, Berlin, 02.08.2005

Parameter	intended use, skin contact less than 30 sec [mg/kg]	intended use, skin contact more than 30 sec [mg/kg]
Benzo[a]pyren	<20	<1
sum 16 PAH (EPA)	<200	<10

Sample No.:	2006-29037	
Sample:	DC-1430	
Parameter	Unit	Result
Naphthalene	mg/kg	1,4
Acenaphthylene	mg/kg	1,2
Acenaphthene	mg/kg	0,1
Fluorene	mg/kg	0,4
Phenanthrene	mg/kg	3,8
Anthracene	mg/kg	0,5
Fluoranthene	mg/kg	7,1
Pyrene	mg/kg	20,8
Benzo(a)anthracene	mg/kg	<0,1
Chrysene	mg/kg	3,0
Benzo(b)fluoranthene	mg/kg	2,2
Benzo(k)fluoranthene	mg/kg	1,2
Benzo(a)pyrene	mg/kg	2,2
Indeno(1,2,3-cd)pyrene	mg/kg	0,8
Dibenz(a)anthracene	mg/kg	0,3
Benzo(ghi)perylene	mg/kg	5,0
Total PAH (EPA)	mg/kg	50,0

Determination limit of the test method: < 0,1 mg/kg per PAH component.

Single components with an amount of < 0,1 mg/kg were not considered by the calculation of the sum. In the case of all 16 PAH according to EPA were not detected, the result is stated n.n.

-END-

Weigeringsgrond 10.2.e

Doc. 20.f.5

ICTPOL

INSTITUTO DE CIÊNCIA E TECNOLOGIA DE POLÍMEROS

PAHs determination according to 'AfPS GS 2014:01 PAH specification'

Product grade: Cryoflex ® DC-0725 cryogenic rubber infill of RECIPNEU

Substance name	CAS No.	mg/kg
Benzo [a] pyrene (BaP)	50-32-8	< 0,30
Benzo [e] pyrene (BeP)	192-97-2	---
Benzo [a] anthracene (BaA)	56-55-3	< 0,15
Benzo [b] fluoranthene (BbFA)	205-99-2	< 0,15
Benzo [j] fluoranthene (BjFA)	205-82-3	---
Benzo [k] fluoranthene (BkFA)	207-08-9	< 0,15
Chrysene (CHR)	218-01-9	< 0,15
Dibenzo [a,h] anthracene (DBAhA)	53-70-3	< 0,30
Benzo [g,h,i] perylene	191-24-2	< 0,30
Indeno [1,2,3-cd] pyrene	193-39-5	< 0,30
Acenaphthylene	208-96-8	< 0,15
Acenaphthene	83-32-9	< 0,15
Fluorene	86-73-7	< 0,15
Phenanthrene	85-01-8	0,24
Pyrene	129-00-0	1,24
Anthracene	120-12-7	< 0,15
Fluoranthene	206-44-0	0,35
Naphthalene	91-20-3	< 0,15
Sum of 18 PAH above		**< 4,4**

Date of tests conclusion: 11 May 2017

Date of sample reception: 8 April 2017

ICTPOL, 11th May 2017

Doc. 20.f.5

ictpol

INSTITUTO DE CIÊNCIA E TECNOLOGIA DE POLÍMEROS

PAHs determination according to 'AfPS GS 2014:01 PAH specification'

Product grade: Cryoflex ® DC-0814 cryogenic rubber infill of RECIPNEU

Substance name	CAS No.	mg/kg
Benzo [a] pyrene (BaP)	50-32-8	< 0,29
Benzo [e] pyrene (BeP)	192-97-2	---
Benzo [a] anthracene (BaA)	56-55-3	< 0,14
Benzo [b] fluoranthene (BbFA)	205-99-2	0,43
Benzo [j] fluoranthene (BjFA)	205-82-3	---
Benzo [k] fluoranthene (BkFA)	207-08-9	< 0,14
Chrysene (CHR)	218-01-9	0,34
Dibenzo [a,h] anthracene (DBAhA)	53-70-3	< 0,29
Benzo [g,h,i] perylene	191-24-2	0,37
Indeno [1,2,3-cd] pyrene	193-39-5	< 0,29
Acenaphthylene	208-96-8	< 0,14
Acenaphthene	83-32-9	< 0,14
Fluorene	86-73-7	< 0,14
Phenanthrene	85-01-8	0,23
Pyrene	129-00-0	1,88
Anthracene	120-12-7	< 0,14
Fluoranthene	206-44-0	0,54
Naphthalene	91-20-3	< 0,14
Sum of 18 PAH above		**< 5,7**

Date of tests conclusion: 11 May 2017

Date of sample reception: 8 April 2017

ICTPOL, 11th May 2017

Doc. 20.f.5

ICTPOL
INSTITUTO DE CIÊNCIA E TECNOLOGIA DE POLÍMEROS

PAHs determination according to 'AfPS GS 2014:01 PAH specification'

Product grade: Cryoflex ® DC-1014 cryogenic rubber infill of RECIPNEU

Substance name	CAS No.	mg/kg
Benzo [a] pyrene (BaP)	50-32-8	< 0,29
Benzo [e] pyrene (BeP)	192-97-2	---
Benzo [a] anthracene (BaA)	56-55-3	< 0,14
Benzo [b] fluoranthene (BbFA)	205-99-2	< 0,14
Benzo [j] fluoranthene (BjFA)	205-82-3	---
Benzo [k] fluoranthene (BkFA)	207-08-9	< 0,14
Chrysene (CHR)	218-01-9	0,14
Dibenzo [a,h] anthracene (DBAhA)	53-70-3	< 0,29
Benzo [g,h,i] perylene	191-24-2	< 0,29
Indeno [1,2,3-cd] pyrene	193-39-5	< 0,29
Acenaphthylene	208-96-8	< 0,14
Acenaphthene	83-32-9	< 0,14
Fluorene	86-73-7	< 0,14
Phenanthrene	85-01-8	0,17
Pyrene	129-00-0	0,98
Anthracene	120-12-7	< 0,14
Fluoranthene	206-44-0	0,29
Naphthalene	91-20-3	< 0,14
Sum of 18 PAH above		**< 3,9**

Date of tests conclusion: 11 May 2017

Date of sample reception: 8 April 2017

ICTPOL, 11th May 2017

ictpol
INSTITUTO DE CIÊNCIA E TECNOLOGIA DE POLÍMEROS

PAHs determination according to 'AfPS GS 2014:01 PAH specification'

Product grade: Cryoflex ® DC-1430 cryogenic rubber infill of RECIPNEU

Substance name	CAS No.	mg/kg
Benzo [a] pyrene (BaP)	50-32-8	< 0,29
Benzo [e] pyrene (BeP)	192-97-2	---
Benzo [a] anthracene (BaA)	56-55-3	< 0,15
Benzo [b] fluoranthene (BbFA)	205-99-2	< 0,15
Benzo [j] fluoranthene (BjFA)	205-82-3	---
Benzo [k] fluoranthene (BkFA)	207-08-9	< 0,15
Chrysene (CHR)	218-01-9	0,32
Dibenzo [a,h] anthracene (DBAhA)	53-70-3	< 0,29
Benzo [g,h,i] perylene	191-24-2	< 0,29
Indeno [1,2,3-cd] pyrene	193-39-5	< 0,29
Acenaphthylene	208-96-8	< 0,15
Acenaphthene	83-32-9	< 0,15
Fluorene	86-73-7	< 0,15
Phenanthrene	85-01-8	0,20
Pyrene	129-00-0	1,55
Anthracene	120-12-7	< 0,15
Fluoranthene	206-44-0	0,41
Naphthalene	91-20-3	< 0,15
Sum of 18 PAH above		**< 4,8**

Date of tests conclusion: 11 May 2017 Date of sample reception: 8 April 2017

ICTPOL, 11th May 2017

Doc. 20.f.6

INSTITUTO SUPERIOR TÉCNICO

Weigeringsgrond 10.2.e

Rubber - Determination of the aromacity of oil in vulcanized rubber compounds

Requested by **ICTPOL –** [redacted]

NMR national network: Spectrometer Bruker Avance III 500.

Responsible: [redacted]

IST, 18th February, 2013

Annex A

Results of 1H NMR analysis of PAH in oil extracts of rubber

The average values of I_0, I_{CHCl3}, I_1, I_2,I_3 and %H_{Bay} are shown below:

Average of:	
I_0	6.6831
I_{CHCl3}	3.1934
I_1	3.4897
I_2	0.3308
I_3	93.3166
% H_{Bay}	**0.3417**

Annex B

Results of integrations in 1H spectra of samples

	I_0	I_{CHCl3}	I_2	I_3
I3.1	6.748	3.1683	0.3309	93.2512
I3.2	6.5875	3.14	0.3309	93.4125
I3.3	6.7138	3.2719	0.3305	93.2861
Average	6.6831	3.1934	0.330767	93.3166

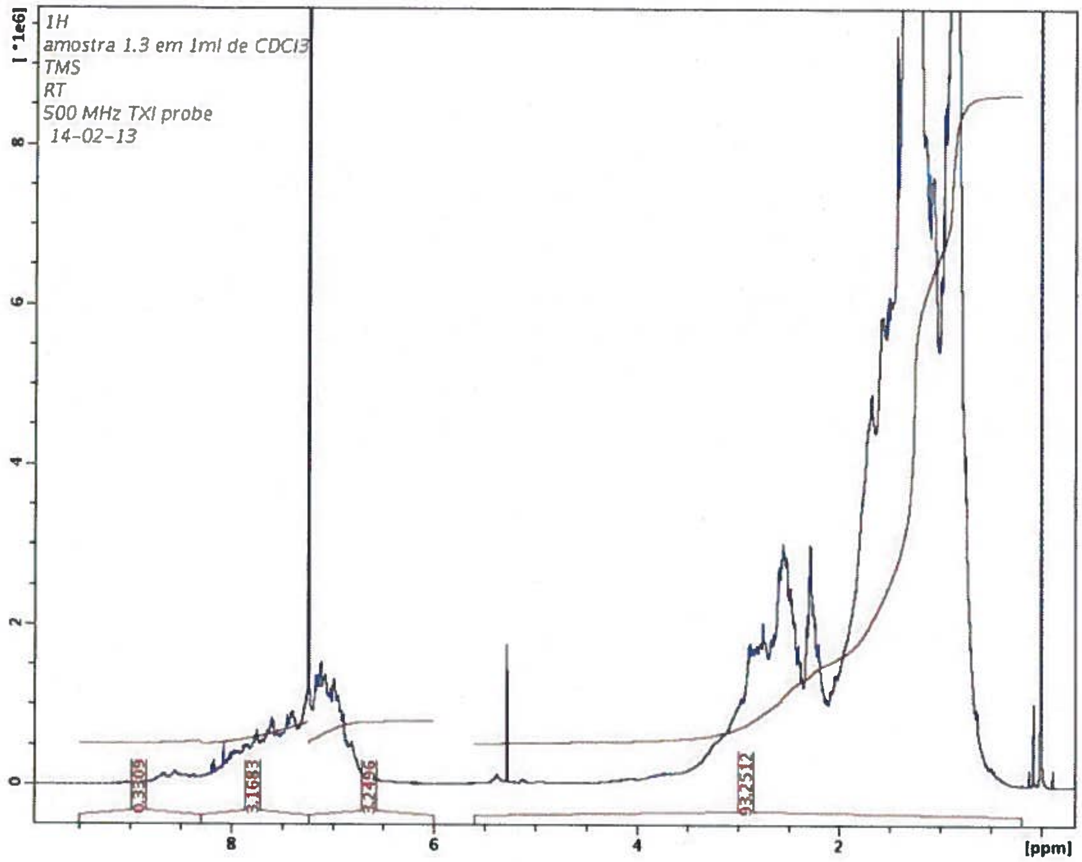
$$\% H_{Bay} = 0.3417$$

^{1}H NMR spectra of oil extracts of rubber with integrations

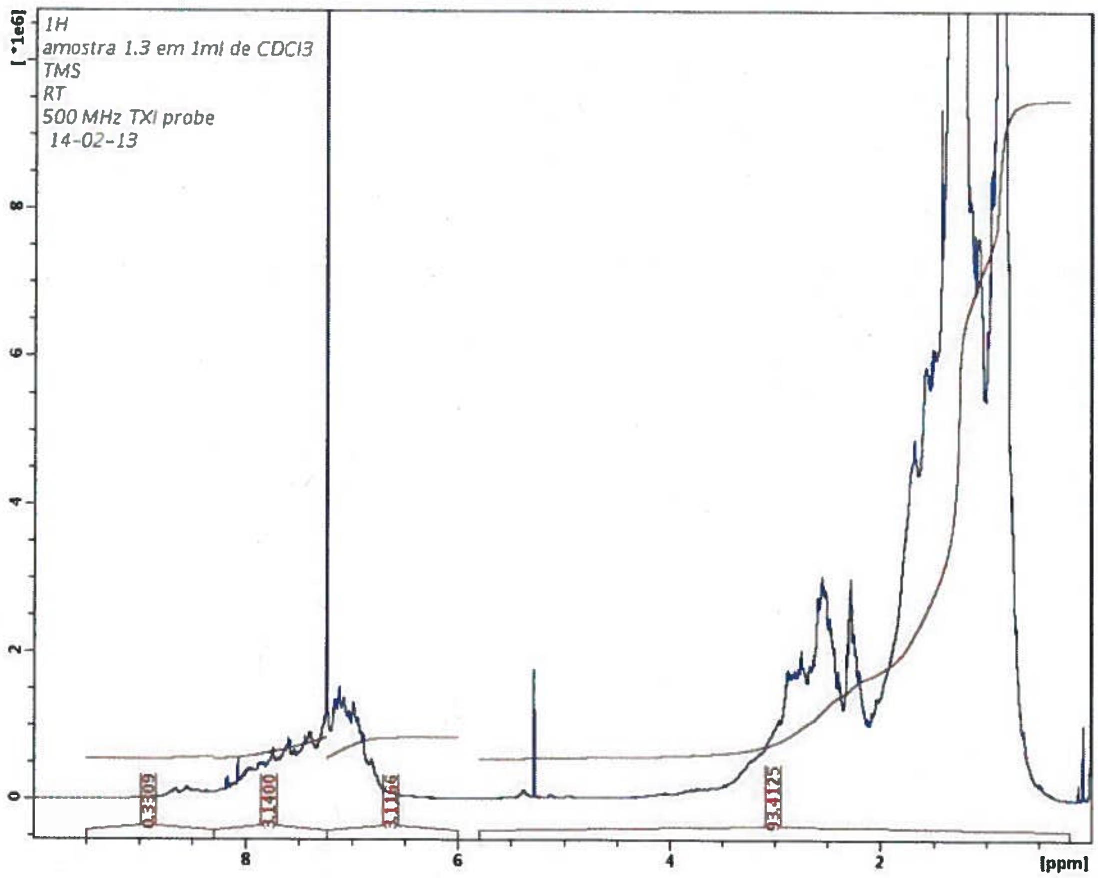
Note that:

- 3 different integrations were done for each sample spectrum
- ^{1}H spectra and integrations are according procedure **ISO 21461**

Doc. 20.f.6

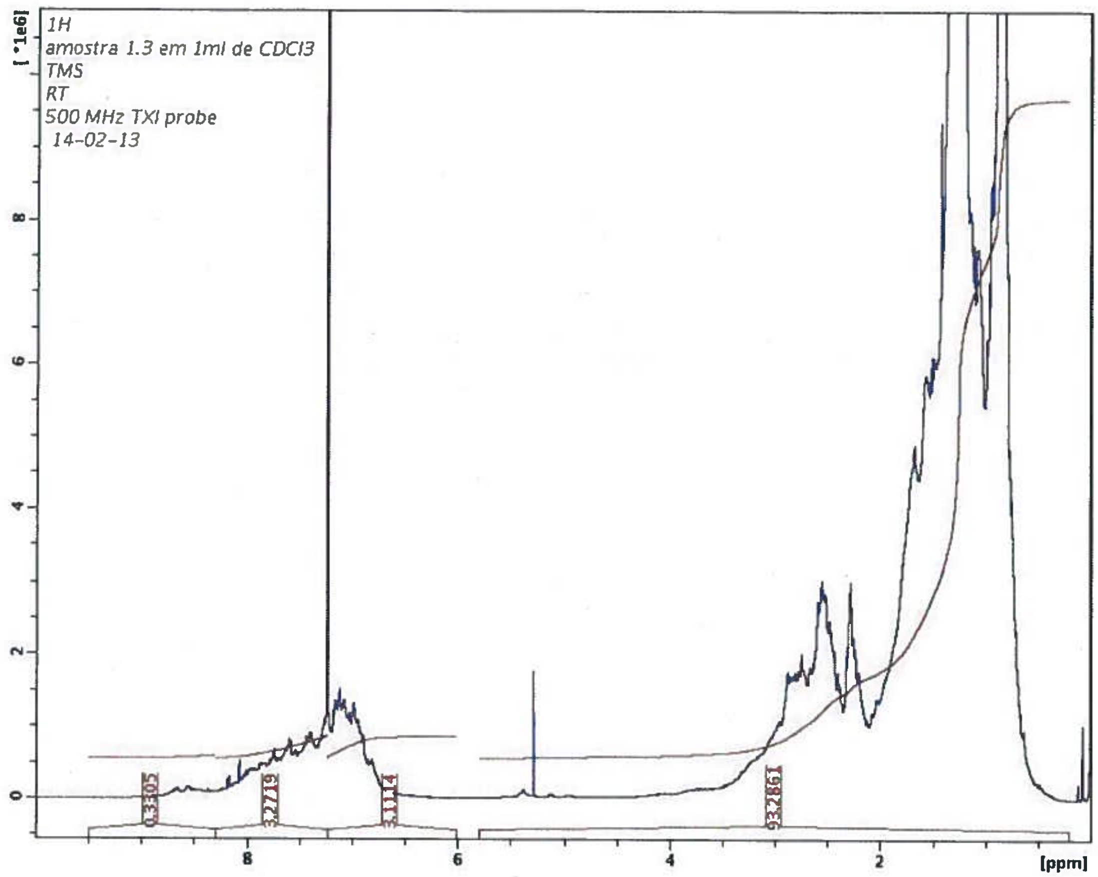


1H
amostra 1.3 em 1ml de CDCl3
TMS
RT
500 MHz TXI probe
14-02-13
[*1e6]
0
2
4
6
8
0.3309
3.1683
3.2456
93.2512
8
6
4
2
[ppm]



1H
amostra 1.3 em 1ml de CDCl3
TMS
RT
500 MHz TXI probe
14-02-13
[*1e6]
0
2
4
6
8
0.3309
3.1400
3.1166
93.4125
8
6
4
2
[ppm]

Doc. 20.f.6



1H
amostra 1.3 em 1ml de CDCl3
TMS
RT
500 MHz TXI probe
14-02-13
[*1e6]
0
2
4
6
8
[ppm]
0.3305
3.2719
3.1114
93.2861

Doc. 20.f.7

Cryoflex®

Cryogenic rubber infill

by Recipneu

Doc. 20.f.7

CRYOGENIC RUBBER INFILL

RECIPNEU produces rubber granulates from end-of-life tyres by means of the cryogenic process technology.

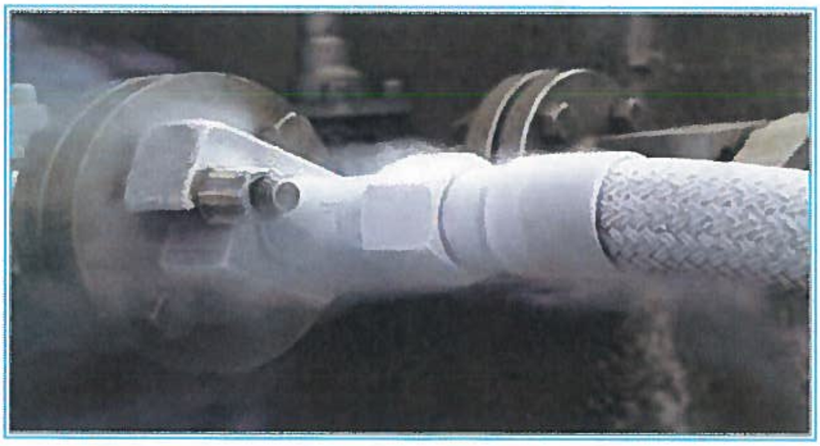
These granulates are used as rubber infill material for synthetic turf, as they impart excellent shock absorption, elasticity, resilience and energy restitution properties, since the cryogenic process employed preserves these properties, pre-existing in the input tyre rubber.

The process begins with shredding the raw material into small chips.

The chips are then dropped into a long cryogenic tunnel and deeply cooled by liquid nitrogen to -80°C, surpassing the glass transition point of the tyre rubber polymers, being the chips thereafter hit by a very strong impact in hammer mills, causing the instantaneous fracture of the "glassy" rubber chips into small rubber granulates.

After cryogenic grinding, steel and textiles are removed, and the rubber is dried and sieved into different standard sizes.

At the end of the process, the rubber particles show regular pattern shapes, with smooth faces - "flat to moderately angular" morphology type – with a very small pore density.
The process doesn't degrade thermally or chemically (by oxidation) the rubber polymers.

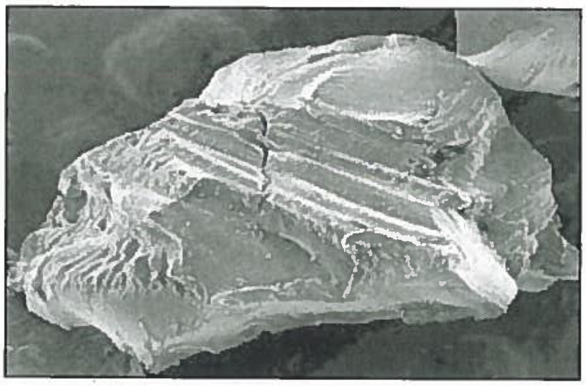


RECIPNEU

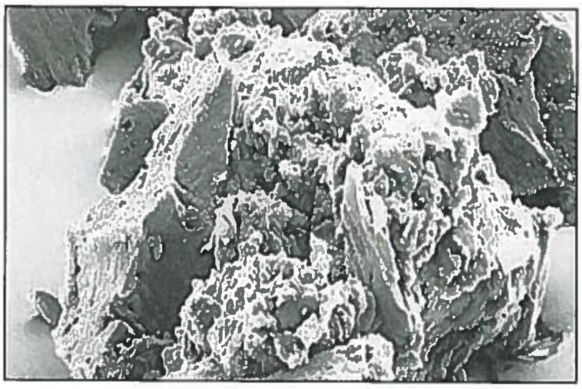
ADDED VALUE OF CRYOGENIC RUBBER INFILL Doc: 20.f.7

STRUCTURE & STABILITY (BEHAVIOR):

Surface Morphologies of Rubber Infill Particles



Electron Micrograph of Cryogenic Rubber Particle
Type "Flat to Moderately Angular"



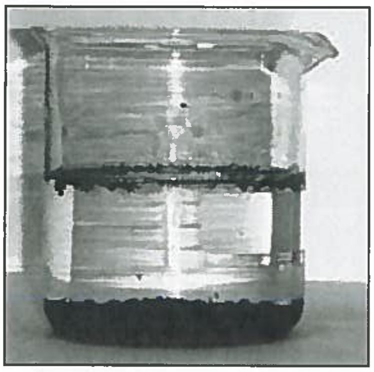
Electron Micrograph of Mechanical Rubber Particle
Type "Spongeous"

- No degradations, thermal (*ultra cold process*) or chemical-oxidative (*no oxygen, only nitrogen*), are introduced in the rubber;
- Flat morphology (*practically no pores)* - the cryogenic rubber particle without pores on the surface, is a kind of a "closed" particle. Its superficial area is minimal and there is not too much interacting/exchanging rubber ingredients with the exterior.
- Behavior like an "encapsulated particle" – minimum leachates, odor and volatiles release;
- Synthetic grass filaments have indeed longer durability under strong UV sun radiation (due to minimal volatiles released from the cryogenic rubber infill);

RECIPNEU

Doc. 20.f.7

Typical Shapes of Rubber Infill Particles



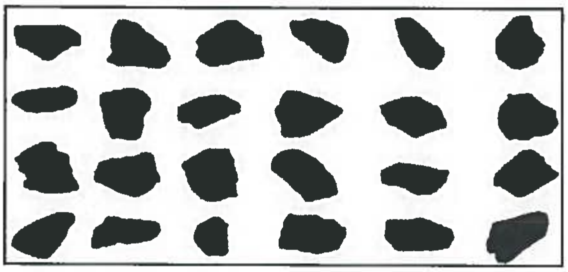
Cryoflex ® Cryogenic Rubber Infill

Mechanical / Ambient Rubber Infill

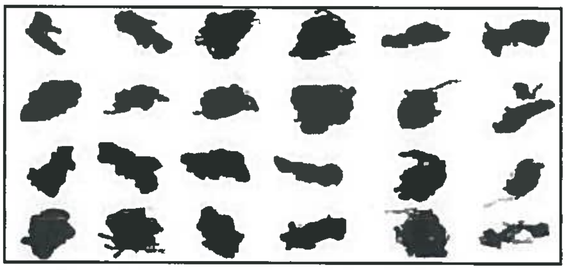
•The absence of pores avoid physical adsorption of air bubbles on the particle surface, so **no floating in the rain water** and the rubber is stable in place.

COMPACTION (BEHAVIOR):

Typical Shape of Rubber Infill Particles



Cryoflex ® Cryogenic Rubber Infill



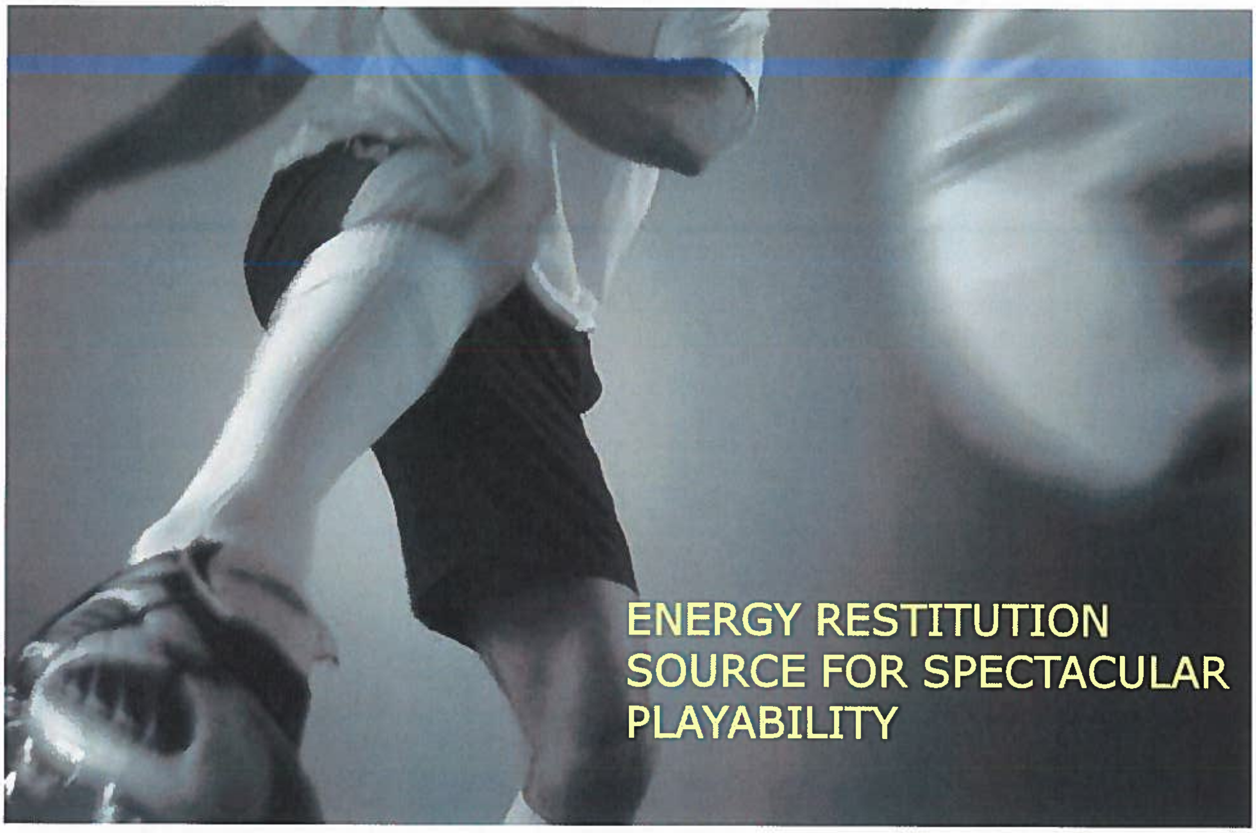
Mechanical / Ambient Rubber Infill

- Cryogenic rubber infill has regular solid shapes; with the silica sand, altogether form a **homogeneous mixture (accurate rubber sizes) of regular shapes in the infill layer, and** once they retain neither air nor water bubbles, an **excellent water drainage is** provided.
- **The cryogenic rubber infill does not compact** due to its good abrasion resistance, avoiding particles to break in smaller powders, and show a prompt elastic recovery due to the non-degraded rubber polymer chains. As a result, the infill keeps having a **good shock absorption** for many years.

RECIPNEU

ATHLETIC PERFORMANCES:

Doc. 20.f.7



The main features of the cryogenic rubber infill leading to players excellent performances are:

- Good elastic properties;
- Minor compaction;
- Additional game comfort: Pitch neither too hard nor too soft;
- Best player's pressure points, grip and twist during the game:
  Good rotational resistance, linear friction Stud, deceleration Value, etc.;
- Improved ball rolling and rebound (vertical & angle);
- Shock absorption and less deformation.

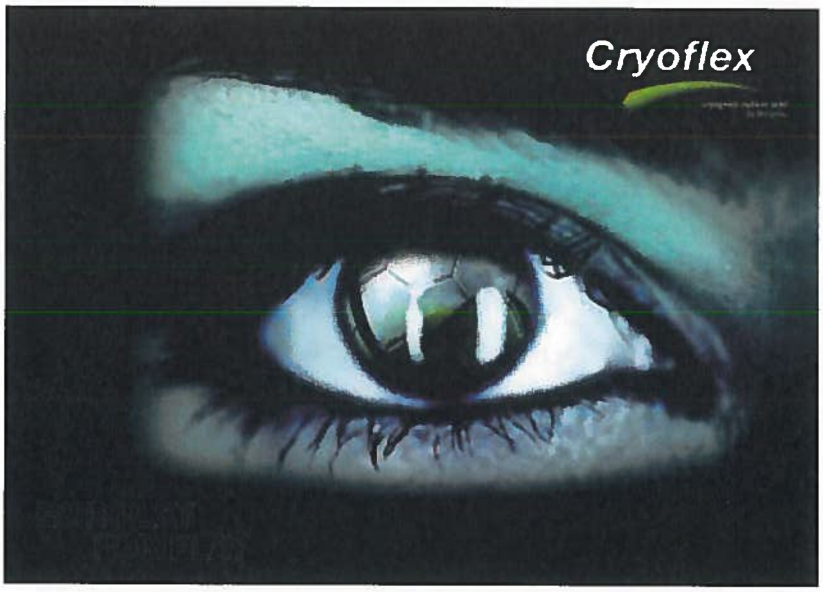
"Any time, any pitch… always the same homogeneous granules assuring high performances and durable artificial pitches…"

RECIPNEU

Doc. 20.f.7

HEALTH & ENVIRONMENTAL FRIENDLY:

- No rubber smell;
- No black powder release (to stain skin or clothes);
- Higher stability in place (no displacement with water flow);
- Compliance with EU standards NF P90-112 and DIN V 18035-7;
- No significant volatiles emission to cause depletion in the UV resistance filters of plastic grass filaments;
- Very high abrasion resistance (resistance to compaction and powderization);
- Negligible release of inhalable particles (PM10 and PM2.5).



RECIPNEU

Doc. 20.f.7

	CRYOGENIC RUBBER INFILL	AMBIENT RUBBER INFILL
BEHAVIOR	Rubber particles with flat surface morphology (low pore density or superficial area per unit mass, very reduced emissions)	Particles with “Spongeous” type morphology (very high pore density, very high superficial area per unit mass, high emissions)
	Particles with regular shape, round to moderately angular – ISA Sport)	Particles with very irregular shapes
	The best Compaction resistance – rubber doesn’t compact during the years of use (TNO Study, Multiturf Project)	Poor Compaction resistance – rubber compacts during the years of use (TNO Study, Multiturf Project)
	Excellent rain water drainage (the field never floods)	Bad rain water drainage (the field gets flooded)
	Higher apparent density, no floating, and stability of rubber in place - no need rubber refills	Lower apparent density, floating particles, and flow with water – need of rubber refills.
	Best ageing resistance – Lisport test (extended durability of the rubber infill layer) (IBV Report and ISA Sport report)	Reasonable ageing resistance
	Excellent mechanical performance *FIFA Quality Concept* (IBV Report)	
	Excellent resistance of the rubber particles to UV radiation (no color change)	Good resistance of the rubber particles to UV radiation (no color change)
	High durability of the artificial grass polymers in contact with the rubber particles (its minimal emissions of sulfur and oil vapors don’t deplete the UV protection chemicals in the grass filaments, so they resist many years)	Reduced durability of the artificial grass polymers in contact with the rubber particles (its high sulfur and oil vapors emissions reacts with the UV protection chemicals in the grass filaments, so they become not protected very soon)

RECIPNEU

Doc. 20.f.7

	CRYOGENIC RUBBER INFILL	AMBIENT RUBBER INFILL
ATL. PERFORMANCE	Excellent elastic properties (molecular structure not degraded in cryogenic production process)	Regular elastic properties (molecular structure much degraded in hot + friction production process)
	Best player's pressure point, grip and twist during the game: good rotational resistance, linear friction stud and deceleration value.	
	More Game Comfort: Pitch neither too hard nor too soft	
HEALTH & ENVIRONMENTAL	Zinc Leachates: Compliance with DIN V 18035-7 standard (Dr. Grunder test, Fresenius Inst.)	
	Compliance with NF P90-112 standard.	
	Compliance with accepted PAH's regulations (TUV test)	
	Practically no rubber smell	Intense rubber smell
	No release of abraded carbon black (no staining / no adherence to skin and clothes)	Staining / adherence to skin and clothes
	Negligible inhalable dust liberation (PM2.5 and PM10)	High amount of inhalable dust liberation (PM2.5 and PM10)

RECIPNEU

Weigeringsgrond 10.2.e

Doc. 20.f.8

Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat:
Tel./Fax Büro: 030-8

Enclosure 1, „DC 0814", 4/4 to the Letter from April 26, 2008

5. Summary for tyre rubber recycling granule "DC 0814 (1.4.08)" from RECIPNEU/Sines

Measuring parameters, requirements and accreditation of the test-laboratory

All tests are done according to the standard DIN V 18035-7, table 7, environmental ascpects only. The results are valued by the requirements of this standard.
All the tests are carried out by the SGS Institute Fresenius in Berlin. This institute and I are accredited for all the experimental methods needed and according to DIN EN ISO/IEC 17025 by the accrediting authority of the DAP, Deutsches Akkreditierungswesen GmbH.

5.1 Test results

measuring parameter	test results	requirements	judgement
EOX	20 mg/kg	≤ 100 mg/kg	okay
DOC	13 mg/l	≤ 20 mg/l resp. ≤ 40 mg/l	okay
Lead/Pb, acid eluate	< 0,005 mg/l	≤ 0,04 mg/l	okay
Cadmium/Cd, acid eluate	< 0,001 mg/l	≤ 0,005 mg/l	okay
Chromium/Cr total, acid eluate	< 0,005 mg/l	≤ 0,05 mg/l	okay
Chromium VI/Cr VI, acid eluate	< 0,005 mg/l	≤ 0,008 mg/l	okay
Mercury/Hg, acid eluate	< 0,0002 mg/l	≤ 0,001 mg/l	okay
Zinc/Zn*, acid eluate	2,5 mg/l; 2,0 mg/l	≤ 3 mg/l, k.o.-Kriterium > 20 mg/l	(okay)
Tin/Sn, acid eluate	< 0,02 mg/l	≤ 0,05 mg/	okay
alternative:			
Zinc/Zn*, hydrous eluate	0,04; 0,04; 0,04 mg/l	≤ 0,5 mg/l, k.o.-Kriterium > 1 mg/l	okay

* One of the alternative requirements (acid or hydrous eluate) must be fulfilled at least, exceeding of one of the k.o.-criteria leads to disqualification of the product.

5.2 Judgement

The ecological requirements of the standard DIN V 18035-7 are fulfilled for the tyre rubber recycling granule "DC 0814 (1.4.08)" from RECIPNEU for all the test-parameters.

It must be emphasized that all the results discussed and valued in this report are only valid for the test sample and that no continuous surveillance of the quality of the product is included.

Date: Berlin, 26.04.2008

Signatu

Weigeringsgrond 10.2.e

Doc. 20.f.9

[redacted]
Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat: 030[redacted]
Tel./Fax Büro: 030-886 [redacted]

Enclosure 1, „DC 1430", 1/4 to the Letter from April 26, 2008

Test report

1. Test sample

The recycling rubber is called in the test report

DC 1430, 1.4.08 for the sample "DC 1430 (0,6-1 mm)"

2. Measuring parameters, requirements and accreditation of the test-laboratory

All tests are done according to the standard DIN V 18035-7, table 7, environmental ascpects only. The results are valued by the requirements of this standard.

All the tests are carried out by the SGS Institute Fresenius in Berlin. This institute and I are accredited for all the experimental methods needed and according to DIN EN ISO/IEC 17025 by the accrediting authority of the DAP, Deutsches Akkreditierungswesen GmbH.

Doc. 20.f.9

[redacted]
Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat: 030[redacted]
Tel./Fax Büro: 030-886 [redacted]

Enclosure 1, „DC 1430", 2/4 to the Letter from April 26, 2008

3. Test results

Proben von Ihnen übersendet — Matrix: Gummigranulat

Probennummer — 8156776
Bezeichnung — REC GG DC 1430

Eingangsdatum — 01.04.2008

Parameter	Einheit		Bestimmungs-grenze	Methode
EOX	mg/kg	20	10	DIN 38414-17
48 h saures Eluat				DIN V 18035-7
Blei	mg/l	< 0,005	0,005	DIN EN ISO 11885
Cadmium	mg/l	< 0,001	0,001	DIN EN ISO 11885
Chrom ges.	mg/l	< 0,005	0,005	DIN EN ISO 11885
Quecksilber	mg/l	< 0,0002	0,0002	DIN EN 1483
Zinn	mg/l	< 0,02	0,02	DIN EN ISO 11885
Zink 1. Messung	mg/l	4,0	0,01	DIN EN ISO 11885
Zink 2. Messung	mg/l	4,2	0,01	DIN EN ISO 11885
48 h wässriges Eluat				DIN V 18035-7
Zink 1. Messung	mg/l	0,05	0,01	DIN EN ISO 11885
Zink 2. Messung	mg/l	0,05	0,01	DIN EN ISO 11885
Zink 3. Messung	mg/l	0,05	0,01	DIN EN ISO 11885
DOC	mg/l	16	5	DIN EN 1484

[redacted]
Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat: 030[redacted]
Tel./Fax Büro: 030-886[redacted]

Enclosure 1, „DC 1430", 3/4 to the Letter from April 26, 2008

4. Discussion of the results

It must be emphasized that all the results discussed and valued in this report are only valid for the test sample and that no continuous surveillance of the quality of the product is included.

DOC, EOX

The requirement of the diluted organic carbon (DOC) in the hydrous 48-h-eluate (limit ≤ 20 mg/l) is with a measured value of 16 mg/l for the sample fulfilled.
Only in the case of a DOC > 20 mg/l but ≤ 40 mg/l, the EOX-values must be valued. The requirement is, that the EOX must be ≤ 100 mg/kg.

Lead (Pb), Cadmium (Cd), Chromium (Cr), Mercury (Hg) and Tin (Sn)

The requirements for these heavy metals in the acidic 48-h-eluate (Pb ≤ 0,04 mg/l, Cd ≤ 0,005 mg/l, Cr total ≤ 0,05 mg/l, Cr VI ≤ 0,008 mg/l, Hg ≤ 0,001 mg/l and Sn ≤ 0,05 mg/l) are fulfilled.

Zinc (Zn)

The requirement for the acidic 48-h-eluate (Zn ≤ 3 mg/l) is with the experimental values of 4,0 mg/l and 4.2 mg/l for the sample fulfilled.
The k.o.-criterium of 20 mg/l is not hurted.
The alternative allowed requirement for the hydrous 48-h-eluate (Zn ≤ 0,5 mg/l) is with the measured experimental values of 0,05 mg/l, 0,05 mg/l and 0,05 mg/l for the sample fulfilled.

Summary

The tested recycling rubber "DC 1430 (1.4.2008)" from RECIPNEU is fulfilling the environmental requirements of the DIN V 18035-7.

Doc. 20.f.9

[redacted]
Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat: 030-[redacted]
Tel./Fax Büro: 030-886 8[redacted]

Enclosure 1, „DC 1430", 4/4 to the Letter from April 26, 2008

5. Summary for tyre rubber recycling granule "DC 1430 (1.4.08)" from RECIPNEU/Sines

Measuring parameters, requirements and accreditation of the test-laboratory

All tests are done according to the standard DIN V 18035-7, table 7, environmental ascpects only. The results are valued by the requirements of this standard.
All the tests are carried out by the SGS Institute Fresenius in Berlin. This institute and I are accredited for all the experimental methods needed and according to DIN EN ISO/IEC 17025 by the accrediting authority of the DAP, Deutsches Akkreditierungswesen GmbH.

5.1 Test results

measuring parameter	test results	requirements	judgement
EOX	20 mg/kg	≤ 100 mg/kg	okay
DOC	16 mg/l	≤ 20 mg/l resp. ≤ 40 mg/l	okay
Lead/Pb, acid eluate	< 0,005 mg/l	≤ 0,04 mg/l	okay
Cadmium/Cd, acid eluate	< 0,001 mg/l	≤ 0,005 mg/l	okay
Chromium/Cr total, acid eluate	< 0,005 mg/l	≤ 0,05 mg/l	okay
Chromium VI/Cr VI, acid eluate	< 0,005 mg/l	≤ 0,008 mg/l	okay
Mercury/Hg, acid eluate	< 0,0002 mg/l	≤ 0,001 mg/l	okay
Zinc/Zn*, acid eluate	4,0 mg/l; 4,2 mg/l	≤ 3 mg/l, k.o.-Kriterium > 20 mg/l	(okay)
Tin/Sn, acid eluate	< 0,02 mg/l	≤ 0,05 mg/	okay
alternative:			
Zinc/Zn*, hydrous eluate	0,05; 0,05; 0,05 mg/l	≤ 0,5 mg/l, k.o.-Kriterium > 1 mg/l	okay

* One of the alternative requirements (acid or hydrous eluate) must be fulfilled at least, exceeding of one of the k.o.-criteria leads to disqualification of the product.

5.2 Judgement

The ecological requirements of the standard DIN V 18035-7 are fulfilled for the tyre rubber recycling granule "DC 1430 (1.4.08)" from RECIPNEU for all the test-parameters.

It must be emphasized that all the results discussed and valued in this report are only valid for the test sample and that no continuous surveillance of the quality of the product is included.

Date: Berlin, 26.04.2008

Signature: [redacted]

Doc. 20.f.9

[redacted]
Ökologische Bewertung von Bauprodukten

Savignyplatz 13
D-10623 Berlin
Tel./Fax privat: 0[redacted]
Tel./Fax Büro: 030-88[redacted]

Enclosure 2, DC 1430", 1/1 to the Letter from April 26, 2008

In addition to the requirements of DIN V 18035-7 some important (for the producer) informations who are not valued.

1. Content of heavy metals (see "Druckaufschluss")

The content of these heavy metals are measured, which are valued in the acidic 48-h-eluate.
The content of the heavy metals Lead, Cadmium, Chromium, Mercury and Tin are all very little and in the normal range for rubber granules.
The content of Zinc is still in the range of tyre-rubber-granules with the measured value of 15100 mg/kg for "DC 1430 (1.4.08).

Proben von Ihnen übersandet — Matrix: Gummigranulat

Probennummer — 815676
Bezeichnung — REC GG DC 1430

Eingangsdatum — 01.04.2008

Parameter	Einheit		Bestimmungs-grenze	Methode
Aufschluß				DIN EN 13656
Blei Pb	mg/kg	4,2	3	DIN EN ISO 11885
Cadmium Cd	mg/kg	0,82	0,3	DIN EN ISO 11885
Chrom ges. Cr	mg/kg	< 1	1	DIN EN ISO 11885
Quecksilber Hg	mg/kg	< 0,1	0,1	DIN EN 1483
Zinn Sn	mg/kg	< 10	10	DIN EN ISO 11885
Zink Zn	mg/kg	15100	1	DIN EN ISO 11885

Weigeringsgrond 10.2.e

Doc: 20.f.10

TEST REPORT

RAPPORT D'ESSAIS / INFORME DE ENSAYOS

Test on infill materials (elastomer) / Essais sur matériaux de remplissage (élastomère) / Materiales de relleno (elastómeros)

Test realized according to NF P90-112, EN 15330-1 standards and FIFA, IRB handbooks
Essais réalisés selon les normes NF P90-112, EN 15330-1 et les référentiels FIFA, IRB
Ensayos segùn las normas NF P90-112, EN 15330-1 y los referenciales FIFA, IRB

CRYOFLEX® DC-0725
RECIPNEU

Report / rapport / informe n°R141589-B1

Date : 11/02/2015

This report has been established from the reports R100486-D2 and R141300-A1 / Ce rapport est établi à partir des rapports R100486-D2 et R141300-A1 / Este informe se ha establecido a partir de los informes R100486-D2 y R141300-A1

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www.labosport.com

SUMMARY / SOMMAIRE / INDICE

1 ■ IDENTIFICATION / IDENTIFICATION / IDENTIFICACION

Information provided by the supplier / Caractéristiques fournies par le fabricant / Características comunicadas por el fabricante

Company Société Empresa	RECIPNEU
Address Adresse Dirección	Parque Industrial de Sines - P.O Box 26 7521 Sines Portugal
Commercial name Nom commercial Nombre del producto	CRYOFLEX® DC-0725
Colour Couleur Color	Black / noire / negro
Nature Nature Naturaleza	SBR

Specimen information / Information concernant l'échantillon / Datos sobre la muestra

Date of order Date de commande Fecha de pedido	13/11/2014
Specimen taken by Echantillons prelevés par Muestra tomada por	RECIPNEU
Date of reception Date de réception Fecha de recepcion	04/08/2014
Receipt number Numéro de réception Número de recepción	015977
Date of tests Date des essais Fecha de ensayos	From/du 04/08/2014 to/au 12/12/2014

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result *** Résultat Resultado	NF P90-112	FIFA	IRB	EN15330-1
Particle shape Forme / Forma	(-)	EN 14955	A2	V	V	V	V
Bulk density Densité / Densidad	(g/cm3)	EN 1097-3	0,45 0,44 0,45 Moyenne : 0,45	V	V	V	V
Particle size							
d	(mm)	EN 933-1	0,800	≥ 0,5	V	V	V
D	(mm)	EN 933-1	2,500	≤ 2,5	V	V	V
Color Couleur / Color	(-)	visual	Black / noire / negro	V	V	V	-
Permeability * Perméabilité / Permeabilidad	(m/s)	EN 12616	0,0150	≥ 0,0001	-	-	-
RAL	(-)	Internal	9005 8022 9011 ΔE=5,64 ΔE=5,66 ΔE=6,35	-	-	-	V
Thermogravimetric Analysis TGA / Analyse thermogravimétrique ATG / Análisis Termogravimétrico ATG		ISO 9924-1	SBR				
charge / charge / carga	(%)		35,4	-	V	V	-
organic / organique / orgánico	(%)		64,6	-	V	V	-
elastomer / élastomère / elastomero	(%)		57,1	> 20	V	V	-

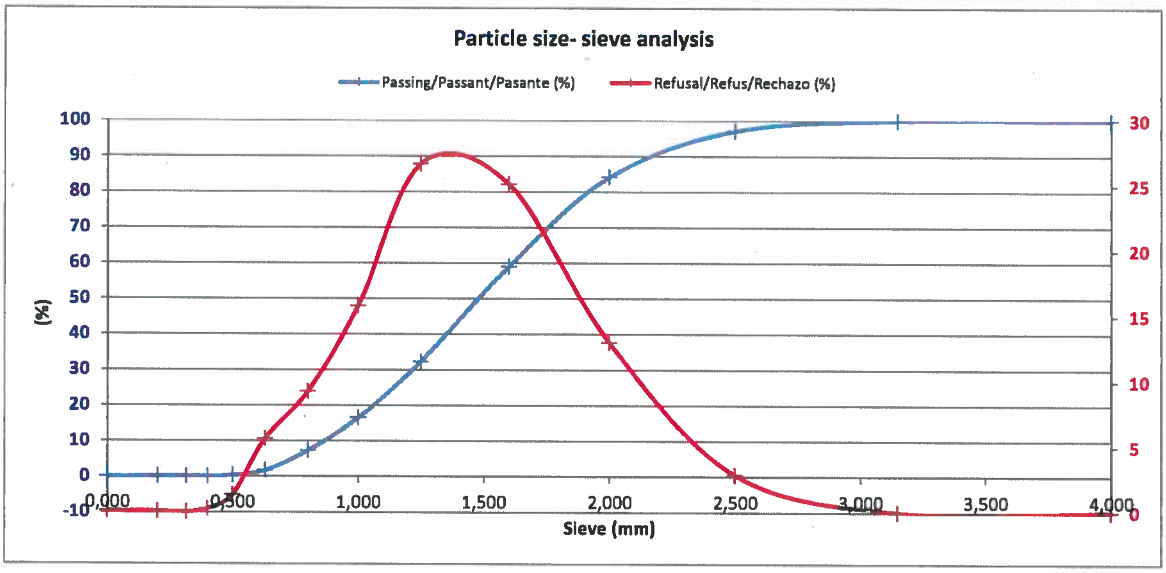
V : required for identification / demandé pour l'identification

*Water temperature/Température de l'eau/Temperatura del agua : 19 °C

*** This results have been taken from the report R141300-A1 / Ces résultats ont été repris du rapport R141300-A1 / Esos resultados son procedentes del informe R141300-A1

Particle size d/D
Granulométrie / Granulometria

Sieve/Tamis/Cribas (mm)	0,000	0,200	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	2,000	2,500	3,150	4,000
Refusal/Refus/Rechazo(g)	201,3	201,2	201,0	201,0	200,5	197,9	186,6	168,0	136,2	82,5	31,9	5,8	0	0
Passing/Passant/Pasante (%)	0	0	0	0	0	2	7	17	32	59	84	97	100	100
Refusal/Refus/Rechazo (%)	0	0	0	0	1	6	9	16	27	25	13	3	0	0

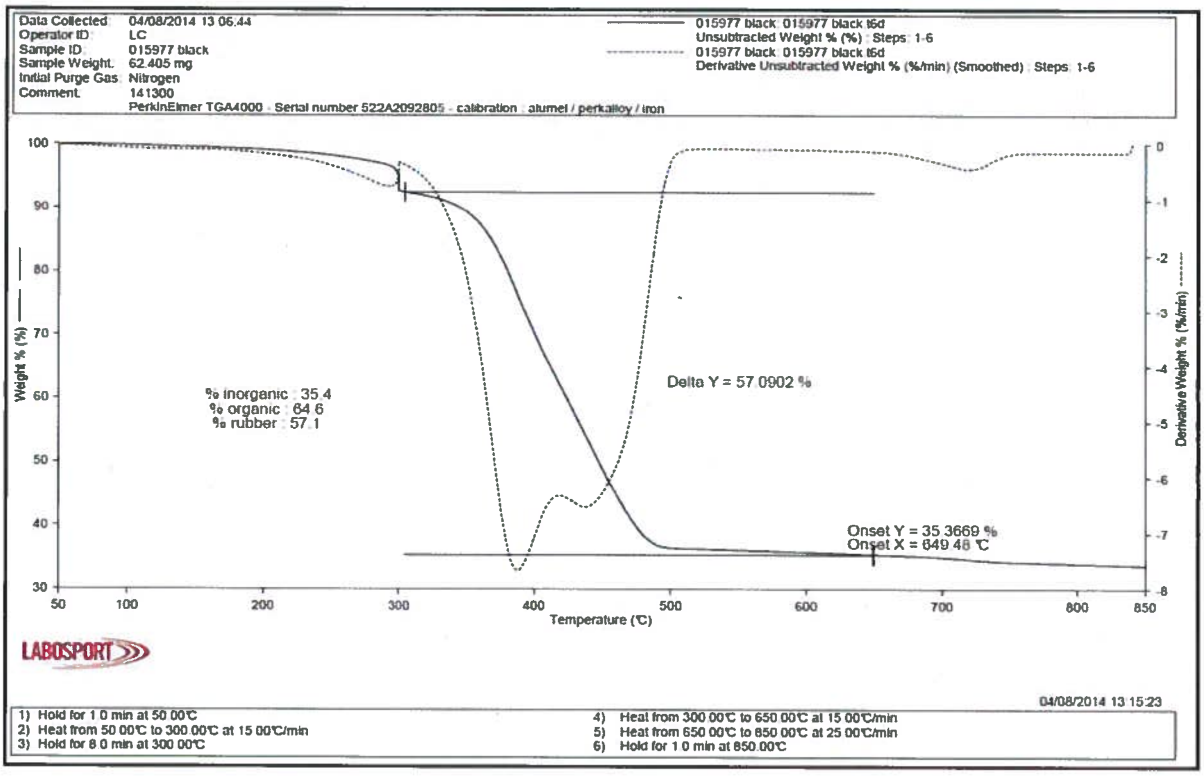


Definitions :

d : largest sieve / plus grand tamis <10%

D : smallest sieve / plus petit tamis >90%

Thermogravimetric Analysis TGA / Analyse thermogravimétrique ATG / Análisis Termogravimétrico ATG



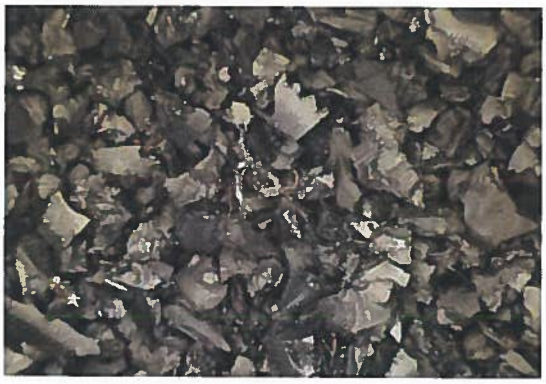
2 ■ WEATHERING / VIEILLISSEMENT / ENVEJECIMIENTO

Hot water ageing then hot air ageing / Vieillissement à l'eau chaude puis à l'air chaud / Envejecimiento al agua caliente y aire caliente

Test method / Norme d'essai / Método de ensayo : EN 13744 / EN 13817

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result Résultat Resultado		NF P90-112
Particle size Granulométrie / Granulometria					
d	(mm)	EN 933-1	0,800	No variation	No variation
D	(mm)	EN 933-1	2,500	No variation	No variation
Color Couleur / Color	(-)	visual	Black and grey / noire et grise / negro y gris		-
Hardness Dureté / Dureza	(-)	internal	No variation		No variation

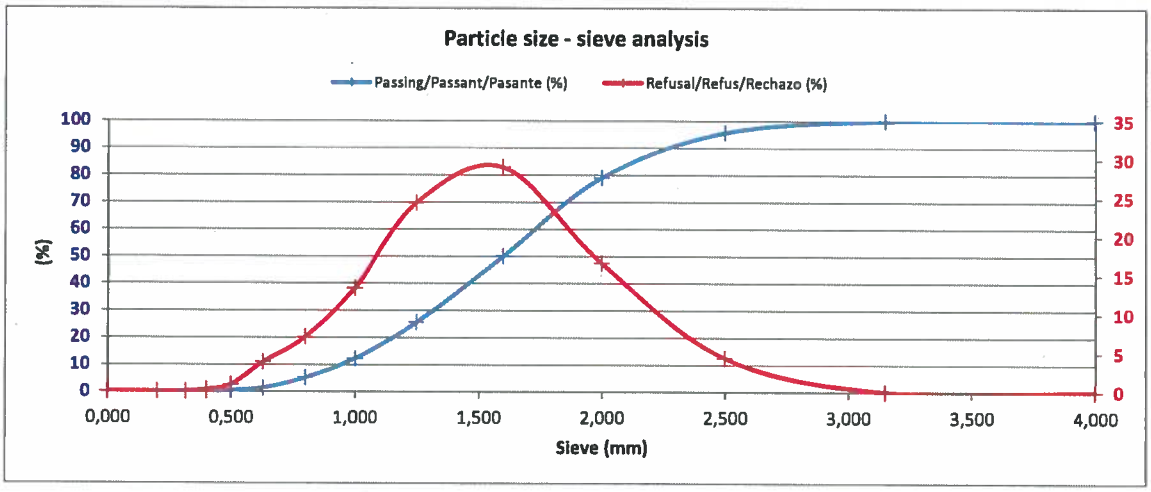
View of the new product
Photographie du produit neuf
Fotographia del producto nuevo



View after ageing
Photographie du produit après vieillissement
Fotographia del producto después del envejecimiento

Particle size d/D
Granulométrie / Granulometría

Sieve/Tamis/Cribas (mm)	0,000	0,200	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	2,000	2,500	3,150	4,000
Refusal/Refus/Rechazo(g)	275,2	275,1	274,9	274,7	273,9	271,4	261,0	241,5	204,7	137,5	57,7	12,0	0	0
Passing/Passant/Pasante (%)	0	0	0	0	0	1	5	12	26	50	79	96	100	100
Refusal/Refus/Rechazo (%)	0	0	0	0	1	4	7	13	24	29	17	4	0	0



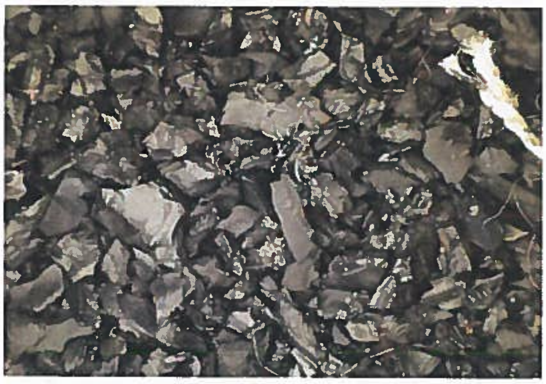
Definitions : d : largest sieve / plus grand tamis <10% D : smallest sieve / plus petit tamis >90%

UVA (340 nm) ageing (4896 kJ) / Vieillissement aux UVA / Envejecimiento UVA

Test method / Norme d'essai / Método de ensayo : EN 14836

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result Résultat Resultado	FIFA	IRB
Color Couleur / Color	(-)	visual	Black / noire / negro	-	-
Grey scale Echelle de gris / Escala de gris	(-)	EN 20105-A02	4-5	≥ 3	≥ 3
Visual aspect Aspect visuel / Aspecto visual	(-)	visual	No agglomeration No cracking	No agglomeration No cracking	- -
Hardness Dureté / Dureza	(-)	internal	No change	-	-

View of the new product
Photographie du produit neuf
Fotographia del producto nuevo



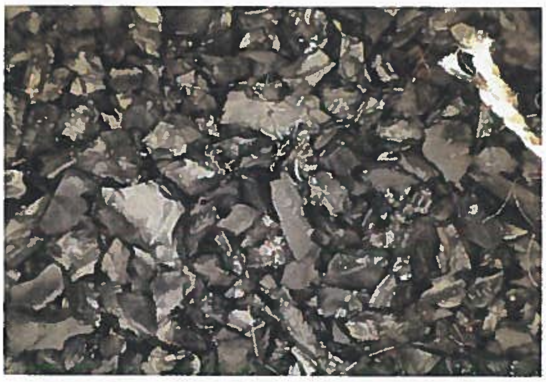
View after ageing
Photographie du produit après vieillissement
Fotographia del producto después del envejecimiento

UVB (313 nm) ageing (4896 kJ) / Vieillissement aux UVB / Envejecimiento a los UVB

Test method / Norme d'essai / Método de ensayo : EN 14836

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result Résultat Resultado	NF P90-112
Color Couleur / Color	(-)	visual	Black / noire / negro	-
Grey scale Echelle de gris / Escala de gris	(-)	EN 20105-A02	5	≥ 3
Visual aspect Aspect visuel / Aspecto visual	(-)	visual	No agglomeration No cracking	No agglomeration -
Hardness Dureté / Dureza	(-)	internal	No variation	-

View of the new product
Photographie du produit neuf
Fotographia del producto nuevo



View after ageing
Photographie du produit après vieillissement
Fotographia del producto después del envejecimiento

3 ■ TOXICOLOGY AND ENVIRONNEMENT / TOXICOLOGIE ET ENVIRONNEMENT / TOXICOLOGIA Y MEDIOAMBIENTE

Samples were prepared by Labosport and analysis performed by SGS laboratory / Les échantillons ont été préparés par Labosport, les analyses réalisées par le laboratoire SGS / LABOSPORT ha preparado las muestras, los análisis se hicieron en el laboratorio SGS.

3.1 Leading / Lixiviation / Lixiviacion

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result ** Résultat Resultado	NF P90-112
Lead Pb Plomb / Plomo	mg/l	NF EN ISO 17294-1 NF EN ISO 17294-2	< 0,010	≤ 0,040
Cadmium Cd Cadmio	mg/l		< 0,002	≤ 0,005
Chromium total Cr Chrome total / Cromo total	mg/l		< 0,010	≤ 0,050
Tin Sn Etain / Estaño	mg/l		< 0,050	≤ 0,050
Zinc Zn(1) with CO_2 Zinc avec CO_2 / Cinc con CO_2	mg/l		1,54	≤ 20
Zinc Zn(2) without CO_2 Zinc sans CO_2 / Cinc sin CO_2	mg/l		0,13	≤ 0,5
Dissolved organic carbone DOC Carbone Organique Dissous	mg/l	NF EN 1484	10,48	≤ 40
Chromium hexavalent Cr Chrome hexavalent / Cromo hexavalente	mg/l	NF T90-043	< 0,005	≤ 0,008
Mercury Hg Mercure / Mercurio	mg/l	NF EN 17852	< 0,0005	≤ 0,0010

NB : For Zinc, one of the two conditions must be necessary / Pour le Zinc, une des deux conditions doit être requise / Para el Cinc, una de las dos condiciones se debe cumplir.

3.2 HAP / EOX

Parameter Elément Elemento	Unit Unité Unidad	Test method Méthode d'essai Método de ensayo	Result ** Résultat Resultado
Extractable Organic Halides EOX Organo-halogénés extractibles EOX Extraibles Orgánica Halogenuros EOX	mg/kg	DIN 38414-17	10

** This results have been taken from the report R100486-D2 / Ces résultats ont été repris du rapport R100486-D2 / Esos resultados son procedentes del informe R100486-D2

SYNTHESIS / SYNTHESE / SÍNTESIS

1. Identification / identification / identificación

Tests Essais / Pruebas	Requirements Exigences / Exigencias	Conformity Conformité / Cumplimiento
Identification identification identificación	NF P 90-112	Pass / conforme / cumple ***

*** This results have been taken from the report R141300-A1 / Ces résultats ont été repris du rapport R141300-A1 / Esos resultados son procedentes del informe R141300-A1

2. Weathering / Vieillissement / Envejecimiento

Tests Essais / Pruebas	Requirements Exigences / Exigencias	Conformity Conformité / Cumplimiento
Hot water ageing then hot air ageing Vieillissement à l'eau chaude puis à l'air chaud Envejecimiento al agua caliente y aire caliente	NF P 90-112	Pass / conforme / cumple
UVA (340 nm) ageing Vieillissement aux UVA Envejecimiento a los UVA	FIFA	Pass / conforme / cumple
	IRB	Pass / conforme / cumple
UVB (313 nm) ageing Vieillissement aux UVB Envejecimiento a los UVB	NF P 90-112	Pass / conforme / cumple

3.Toxicology and environnement / Toxicologie et environnement / Toxicologia y medioambiante

Tests Essais / Pruebas	Requirements Exigences / Exigencias	Conformity Conformité / Cumplimiento
Toxicology leaching Analyses toxicologiques par lixiviation Toxicologia por lixiviación	NF P90-112	Pass / conforme / cumple **

** This results have been taken from the report R100486-D2 / Ces résultats ont été repris du rapport R100486-D2 / Esos resultados son procedentes del informe R100486-D2

Date : 11/02/2015

THE GRASS YARN & TUFTERS FORUM 2006

11-13 December 2006, Renaissance Hotel
Düsseldorf , Germany

Introducing *CRYOFLEX*®,

Cryogenic Rubber Infill by RECIPNEU

A competitive technologic product

recommended for Foot-ball and Environment

[redacted]

RECIPNEU

[redacted]

[redacted]

- [redacted]
- Profissional background in [redacted]
- [redacted]

Doc. 20.f.11

RECIPNEU

Empresa Nacional de Reciclagem de Pneus, Lda

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RECIPNEU

The European Leader in Cryogenic Rubber

- **Plant Site:** Sines Industrial Park, Portugal
- **Land Area :** 40,000 m2
- **Plant Area :** 3,000 m2
- **Technology:** Primary direct cryogenic
- **Start-up date :** Early 2001
- **Work force :** 36

www . recipneu . com

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Empresa Nacional de Reciclagem de Pneus, Lda

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Quality and Environmental CERTIFICATIONS

RECIPNEU is a CERTIFIED COMPANY since 22/DEC/2004:

Quality: ISO 9001:2001

Certificada ISO 9001 por BVQi
ACREDITAÇÃO IPQ
99/OCF 04 Certificação Gestão da Qualidade

Environment: ISO 14001:1999

Certificada ISO 14001 por BVQi
ACREDITAÇÃO IPQ
02/OCA 03 Certificação Gestão Ambiental

Two types of "Tyre Rubber Infill":
1. The Mechanical Rubber Infill

Also called "ambient", the rubber grinding is based in:

- very high electric power of motors,

- converted in very high mechanical energy ("Work")

- shear, friction, cutting, abrasion,

All these actions develop a very high T°C in the rubber, during a significant long time period (minutes), under the presence of the air (oxygen).

➡ "Rubber cooking" conditions: hot, slow, and oxidative.

Result: chemical degradation, irregular shapes, high pore density, or "open particles" (odor/ emissions / leachates).

Two types of "Tyre Rubber Infill": 2. The Cryogenic Rubber Infill

The ***CRYOFLEX***® Cryogenic Rubber Infill grades are obtained by the Cryogenic Process of RECIPNEU.
It is a high technology process, running continuously (24 h/day, 7 days/week) around the year.

In this New Technology, the rubber grinding is done below Tg (of all the rubber polymers) by an instantaneous impact of special hammer mills, under the specific operating conditions:

- Extremely Cold : rubber at -80°C (cryogenic temperature)
- Extremely fast (milliseconds): just the hammer impact time
- Inert atmosphere: Nitrogen (no oxidative)

➡ No "rubber cooking" conditions: cold, fast, no oxidative.

Glass Transition Points

Rubber Polymers	Tg (^oC)
NR Natural Rubber	- 58
IR Polyisoprene Rubber	- 58
SBR Rubber (various grades)	- 52 to - 48
BR Polybutadiene Rubber	- 73
IIR Butyl Rubber	- 58

Liquid Nitrogen Tank (120 ton)

Cryogenic Tunnel (12m) and Dryer

Hammer mills bunker, dryer, and primary textile / magnetic separation

Rubber Classification and Silos

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Chemistry of Our Products (1)

Raw Material: The excellent **vulcanized tyre rubber compounds** (Tyres are the best technological and quality rubber product in the world)

Anti-ageing inherent properties : Tyre rubber materials do resist to most severe weather conditions (UV radiation, water, high and low temperatures, air oxidation, etc.), and also to mechanical fatigue during all the service life (choc absorption / elastic recovery).

Polymer approach: RECIPNEU works on a vulcanized compound of Rubber Polymers + Chemical Specialties **without introducing significant Chemical or Physical degradation** during the process.

Result: Transform the raw material into 1st quality rubber granulates.

Result: *CRYOFLEX*® Rubber Infill granulates do maintain the excellent tyre original properties: elastic, mechanical, and anti - ageing.

Chemistry of Our Products (2)

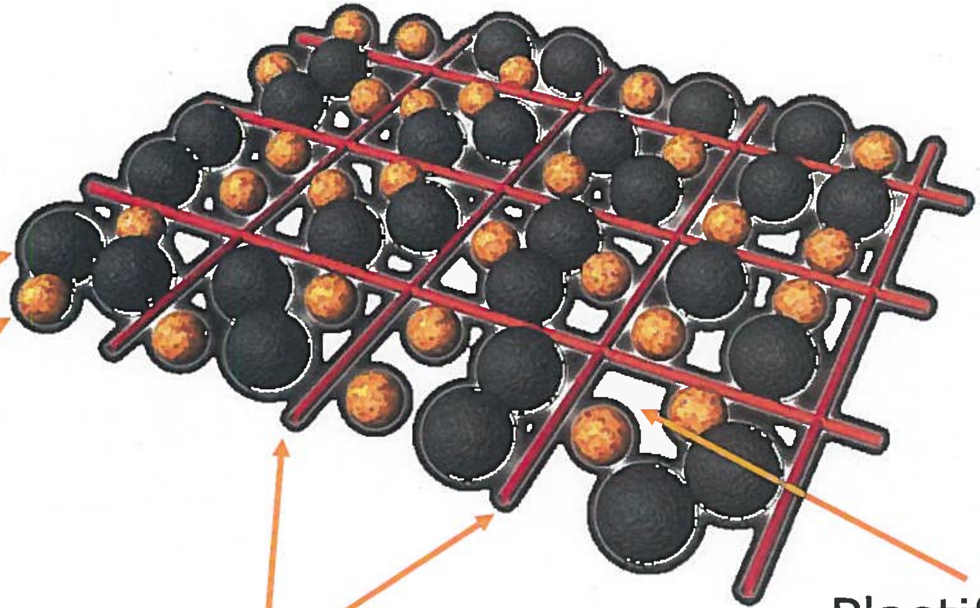
Main Tyre polymers (about 50% weight – a very rich material):

- NR : Natural Rubber (cis-polyisoprene)
- IR : Polyisoprene Synthetic Rubber
- SBR : Synthetic Rubber (random copolymer of styrene-butadiene)
- BR : Polybutadiene Rubber (butadiene polymer)
- IIR : Poly-isobutylene or Butylic Rubber

Fine Chemical Specialties: present in the tyre rubber as compounding & vulcanizing agents, stabilizers, and anti-ageing protective ingredients.

- Carbon Black and Silica
- Anti-oxidants and Anti-ozonants
- UV stabilizers and thermal stabilizers
- Amines (anti stripping agents)
- Aromatic Oils
- Other specialties: Vulcanizing Agents, Zinc oxide, Stearic acid, etc.

The typical rubber mix



Carbon Black + Silica (30-40%)

Rubber Polymer Chains (40–55%)

Plastifier Oils (10–20%)

+ Vulcanizers (1 – 3%) (sulfur, zinc oxide, sulfenamid, etc.)

Comparison of Shape and Morphology

In the next two slides, it is shown the differences in Shape and Morphology of *CRYOFLEX*® Cryogenic Rubber Infill, and the traditional Mechanical/Ambient Rubber Infill.

It is a very clear difference, that is due to the very different production processes for the rubber grinding:

MECHANICAL process: very hot, slow, and oxidative (O2)

→ Chemical degradation, "Open" particles, High emissions

CRYOGENIC process: very cold, very fast, and inert (N2)

→ No chem. degradation, "Closed" particles, Low emissions

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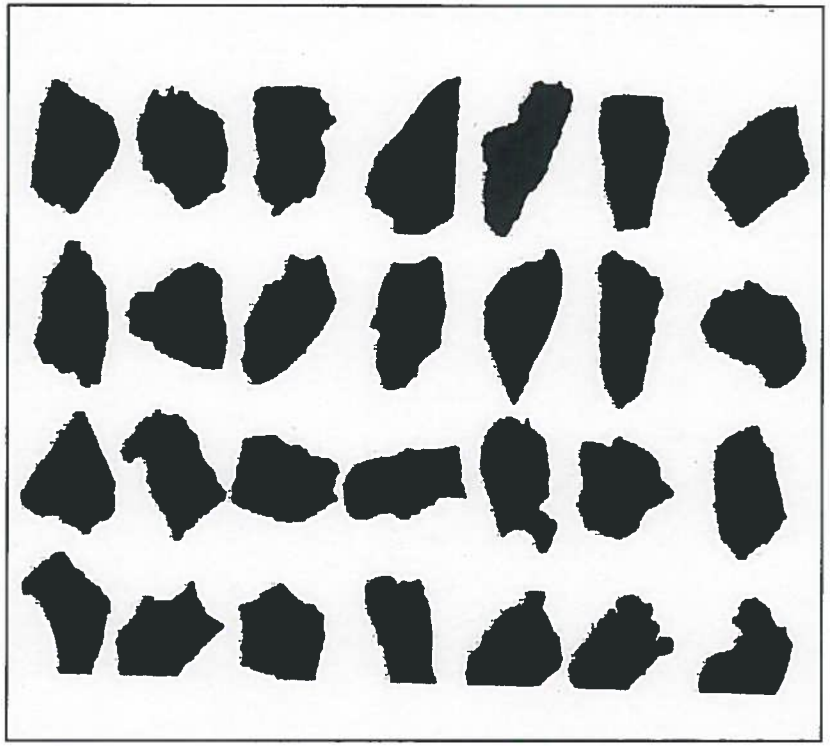
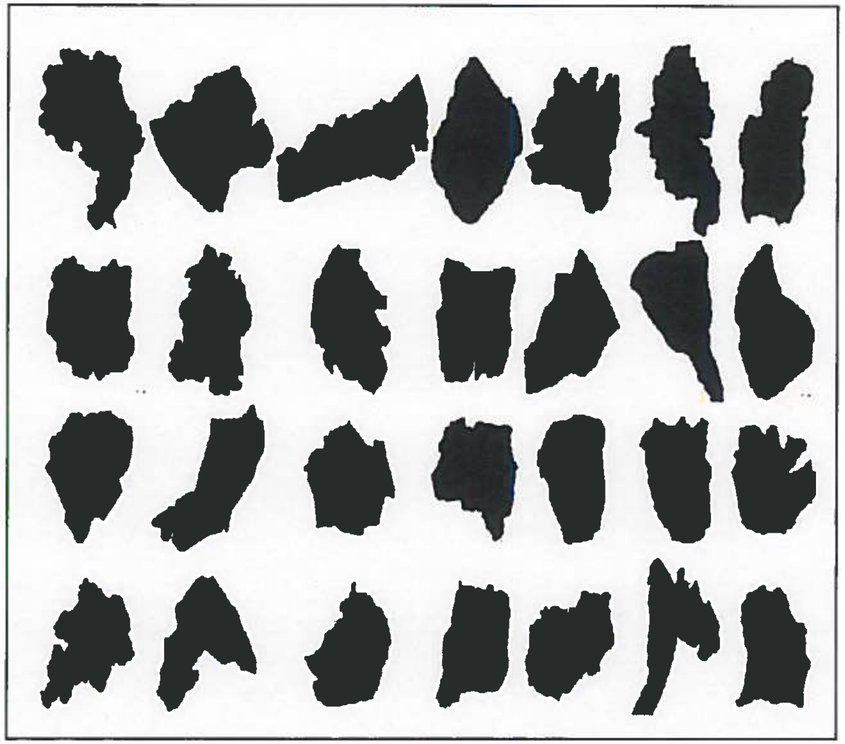
Particle Shape Profiles (Advanced Image Analysis)

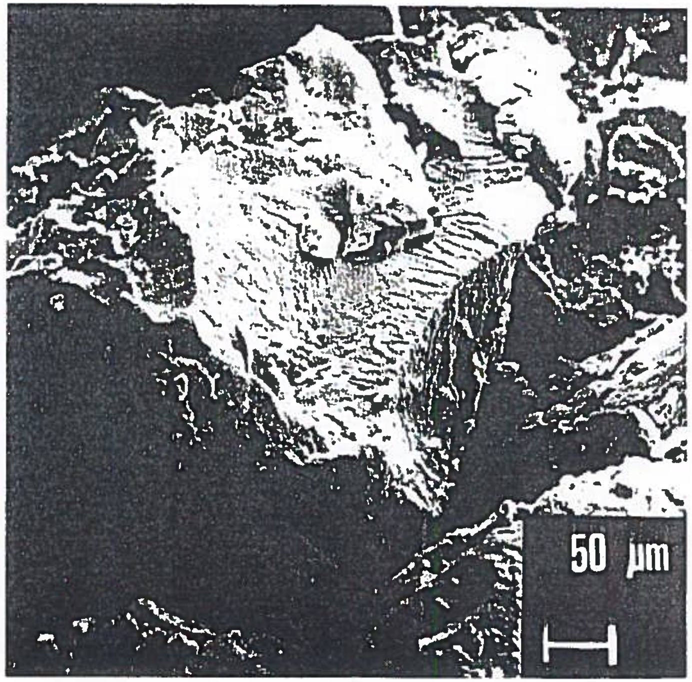


Cryogenic Rubber Particles:
Regular pattern shape
"Cuboid Type"

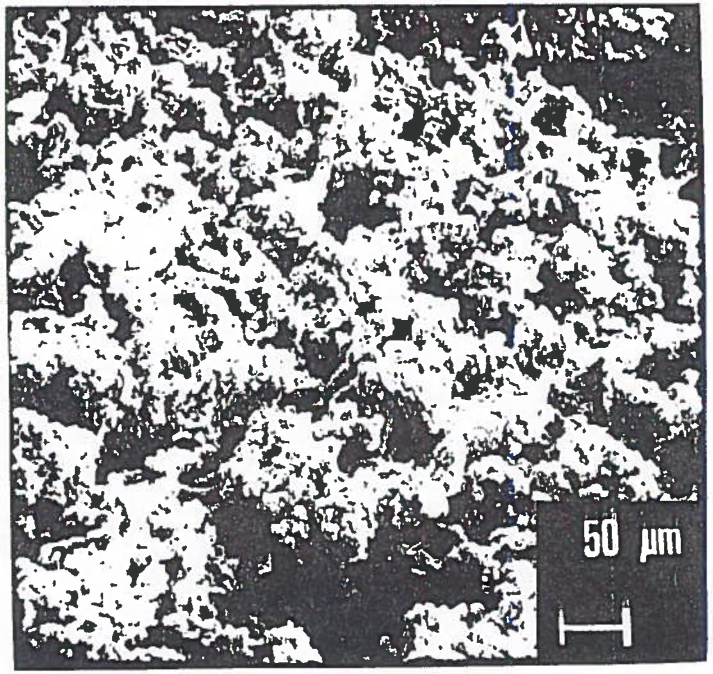


Mechanical Rubber Particles:
Irregular pattern shape
"Spongeous Type"

Surface Morphologies (Electron Micrograph)



Cryogenic Rubber Particle
Closed particle
"Cuboid Type"



Mechanical Rubber Particle
Open particle
"Spongeous Type"

Superficial Area (per unit mass)

[Cryogenic Rubber Infill] <<< [Mechanical Rubber Infill]

The "in-out" exchange phenomena - transfers or emissions from the inside to the outside of the rubber particle - do occur always through its physical surface.

That`s why the emissions are accordingly very much reduced in the *CRYOFLEX*® Rubber Infill particles (odor, zinc leachates, sulfur vapors, oil vapors, PAHs, etc.).

The *CRYOFLEX*® Rubber Infill behaves naturally as an "encapsulated" particle (without any external coating layers), due to its extremely low superficial area, which is a intrinsic important factor for reducing emissions.

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Other relevant performances

CRYOFLEX® Rubber Infill from RECIPNEU has a flat morphology, minimum pore density, minimum superficial area, and regular geometrical shapes ("Cuboid type"). That means:

- Stability in place and in time – very reduced / minimal rubber refills
  (no pores means no air adsorption on the particle surface, then higher apparent density = no rubber floating in water)
- Superior rain water drainage
  ("cuboid type" means a lot more voids space in the rubber layer – no flooding by compaction)
- Negligible to null rubber smell
- Environmental Compliance - Standard DIN V 18035-7 and others
  (minimum emission of heavy metal leachates and other organic pollutants, PAHs, etc.)

Optimal Properties = VERY COMPETITIVE RUBBER INFILL PRODUCT

Rubber Infill Properties

CRYOFLEX® Rubber Infill show excellent performances, some are relevant to match *'The FIFA Quality Concept'*, based in the following optimal properties:

- Shock absorption / elasticity
- Anti - ageing resistance
- Abrasion resistance

These facts are derived from the very rich tyre rubber compounds, and its non-detrimental cryogenic processing at RECIPNEU.

Required specifications for a foot-ball field FIFA **

Parameters:	***Requirements:***
Force reduction	60 – 70%
Energy restitution	20 – 40%
Vertical deformation	4 – 8 mm
Vertical ball bounce	60 – 85 cm

… ***CRYOFLEX***® **Rubber Infill grades can match it …**

... A NEW and Different Product...

In fact, there are many and significant differences between *CRYOFLEX*® Cryogenic Rubber Infill and Mechanical Rubber Infill. Just naming some of them:

- **Production Technology is TOTALLY different;**
- **Physical and Chemical properties are different;**
- **Performances (in the field) are different;**
- **Emissions/odor/abrasion resistance/etc. are different.**

Really, they are very DIFFERENT Products.

***CRYOFLEX*® Rubber Infill grades are efficient and a very competitive solution for Foot-ball fields.**

End of Presentation

Thanks for your attention.

In case you need any information I can assist, feel free to contact me at

[redacted]@recipneu.com
[redacted]@gmail.com

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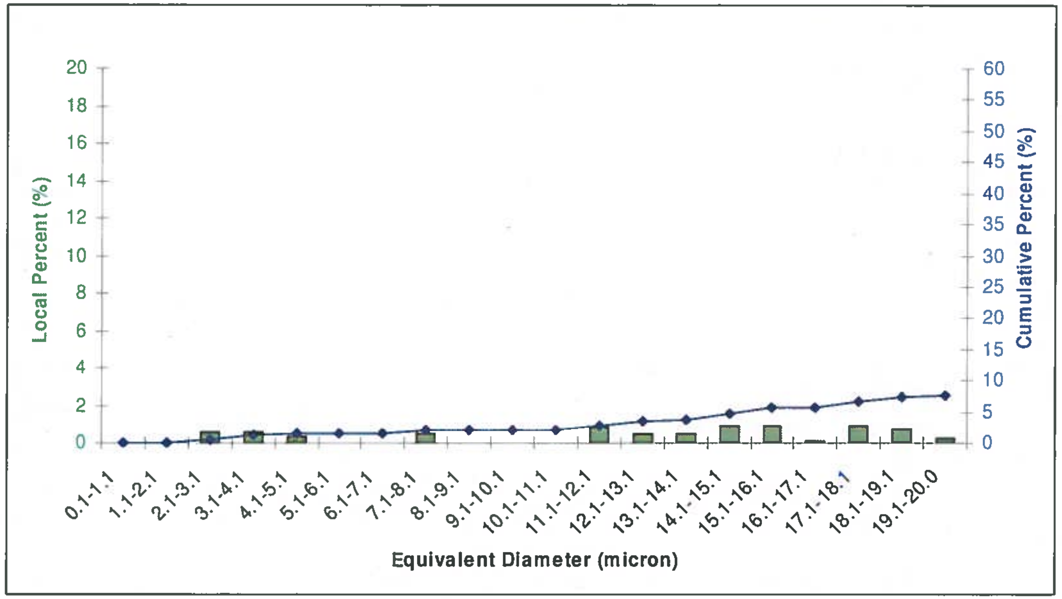
Inhalable Dusts content

Measurements by laser analysis in the Product as is

A) Cryoflex ® *cryogenic rubber infill*

Inhalable Dust	
	(%)
PM 2,5	0,34
PM 10	1,61



Cryoflex ® Cryogenic Rubber Infill

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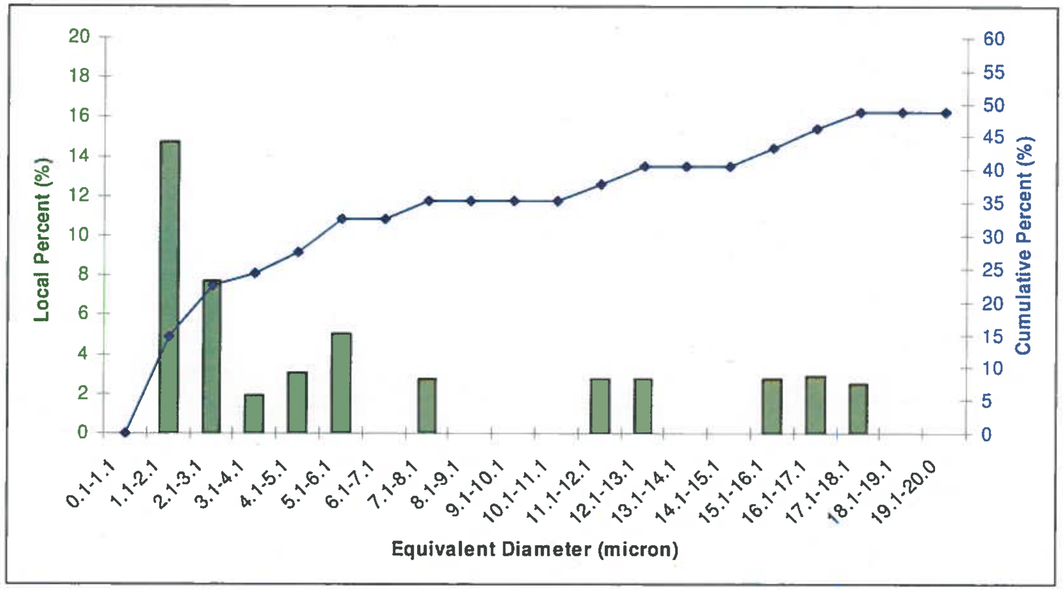
Inhalable Dusts content

Measurements by laser analysis in the Product as is

B) Mechanical (*ambient*) rubber infill

Inhalable Dust	
	(%)
PM 2,5	16,24
PM 10	35,17



Mechanical *(ambient)* Rubber Infill

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Cryoflex ® Cryogenic Rubber Infill

Inhalable Dust		
Range (µ)	Local (%)	Under (%)
0.1-1.1	0	0
1.1-2.1	0	0
2.1-3.1	0,57	0,57
3.1-4.1	0,55	1,12
4.1-5.1	0,36	1,49
5.1-6.1	0	1,49
6.1-7.1	0	1,49
7.1-8.1	0,46	1,95
8.1-9.1	0	1,95
9.1-10.1	0	1,95
10.1-11.1	0	1,95
11.1-12.1	0,85	2,8
12.1-13.1	0,53	3,33
13.1-14.1	0,46	3,79
14.1-15.1	0,92	4,72
15.1-16.1	0,87	5,58
16.1-17.1	0,06	5,64
17.1-18.1	0,92	6,57
18.1-19.1	0,74	7,3
19.1-20.0	0,23	7,54

Mechanical (*ambient*) Rubber Infill

Inhalable Dust		
Range (µ)	Local (%)	Under (%)
0.1-1.1	0	0
1.1-2.1	14,7	14,7
2.1-3.1	7,71	22,42
3.1-4.1	1,93	24,35
4.1-5.1	3,04	27,39
5.1-6.1	5,06	32,44
6.1-7.1	0	32,44
7.1-8.1	2,72	35,16
8.1-9.1	0	35,16
9.1-10.1	0	35,16
10.1-11.1	0	35,16
11.1-12.1	2,71	37,87
12.1-13.1	2,73	40,6
13.1-14.1	0	40,6
14.1-15.1	0	40,6
15.1-16.1	2,72	43,33
16.1-17.1	2,9	46,23
17.1-18.1	2,54	48,76
18.1-19.1	0	48,76
19.1-20.0	0	48,76

Weigeringsgrond 10.2.e

Doc. 20.f.13

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STUDY ON SHAPE OF RUBBER INFILL PARTICLES TO BE USED IN ARTIFICIAL TURF SPORT FIELDS

Introduction

This study has been done in RECIPNEU Laboratory by accurate testing of different rubber granulates existing in the Market. Measurements have been done by a new laser - video Particle Size Analyzer equipment.

The amount of product to test in each measurement provided to obtain always more than a 95% statistical confidence level, sometimes up to 99%. The equipment set up on these parameters adjusts automatically the duration of each measurement test, and therefore the necessary quantity of each sample to be measured accordingly.

Due to this very high confidence level, all the results are statistically reliable, representing each product sample.

The samples analyzed cover the **Cryoflex® *cryogenic rubber infill*** Product DC-0814 obtained by our cryogenic process and as well some other representative samples of other producers that use the mechanical (*ambient*) process to obtain mechanical (*ambient*) rubber infill granulates.

In the next pages, we present size and shape analysis of the following products:

RECIPNEU Product:

- **Cryoflex® *cryogenic rubber infill*** Product Ref. Code DC - 0814

Mechanical (ambient) Rubber Infill Products (not from RECIPNEU) :

- Ref. Fr_1; Ref. Fr_2; Ref. Fr_3; Ref. Sp_1; and Ref. Sp_2

For ethical reasons we do not absolutely mention the name of these producer companies where the samples of the mechanical (*ambient*) rubber infill products come from.

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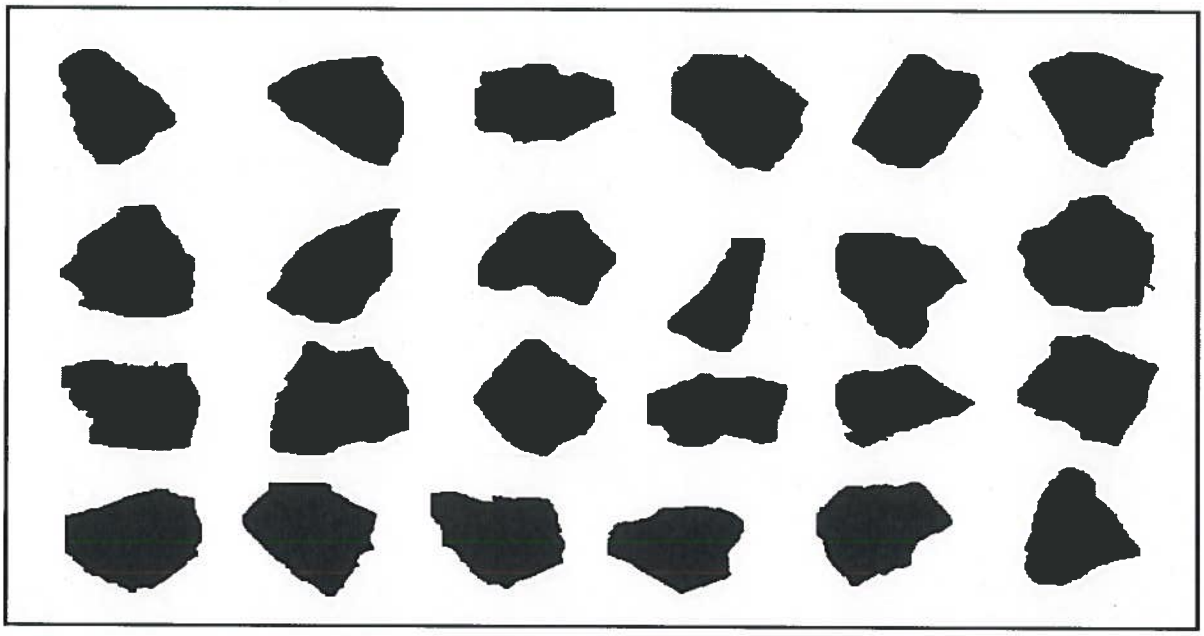
Shape Analysis – Real Photos



Cryoflex® ***cryogenic rubber infill*** Product Ref. Code DC - 0814

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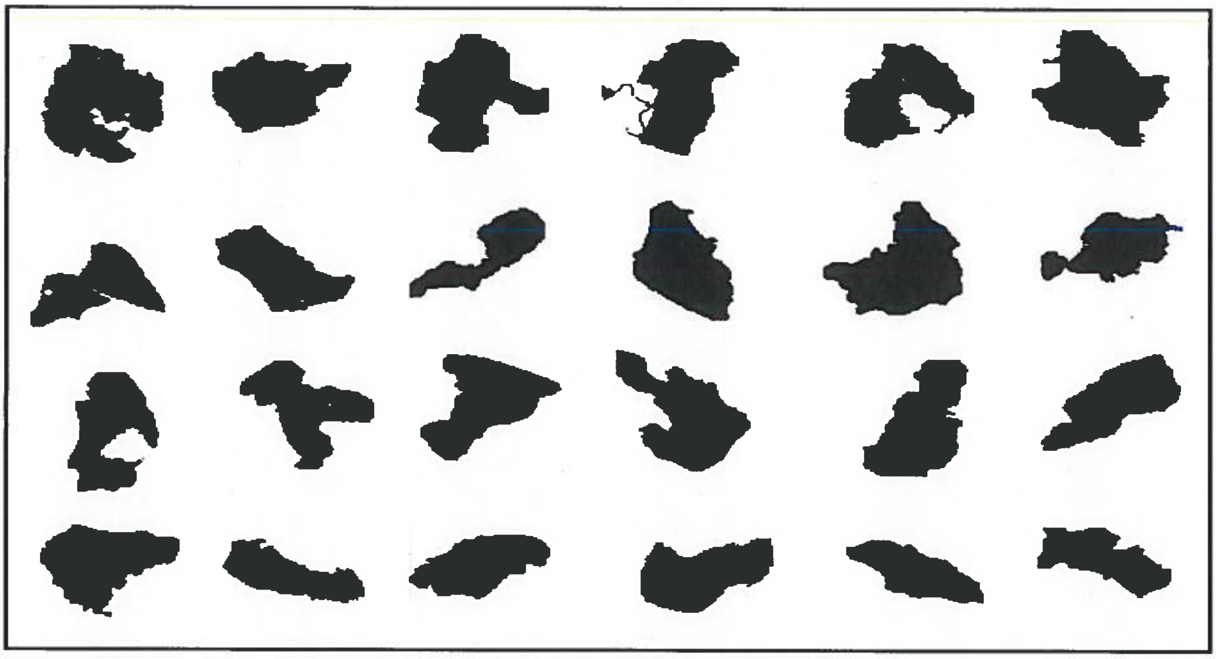
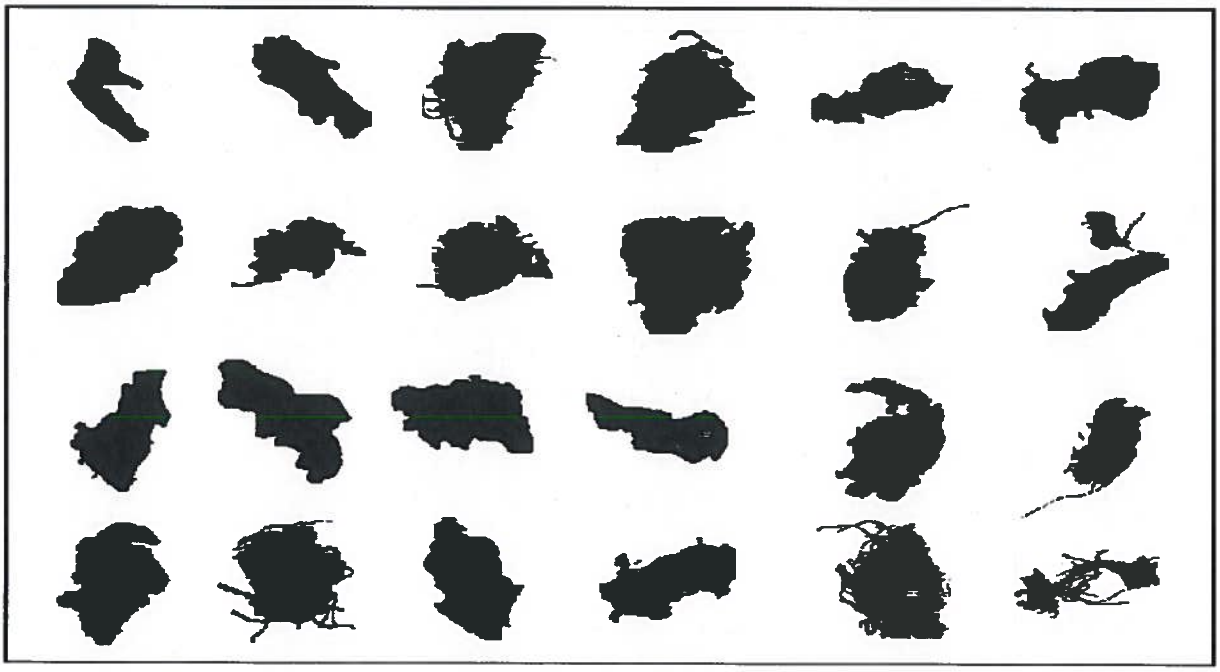


Ambient Rubber Infill Ref. Fr_1



Ambient Rubber Infill Ref. Fr_2

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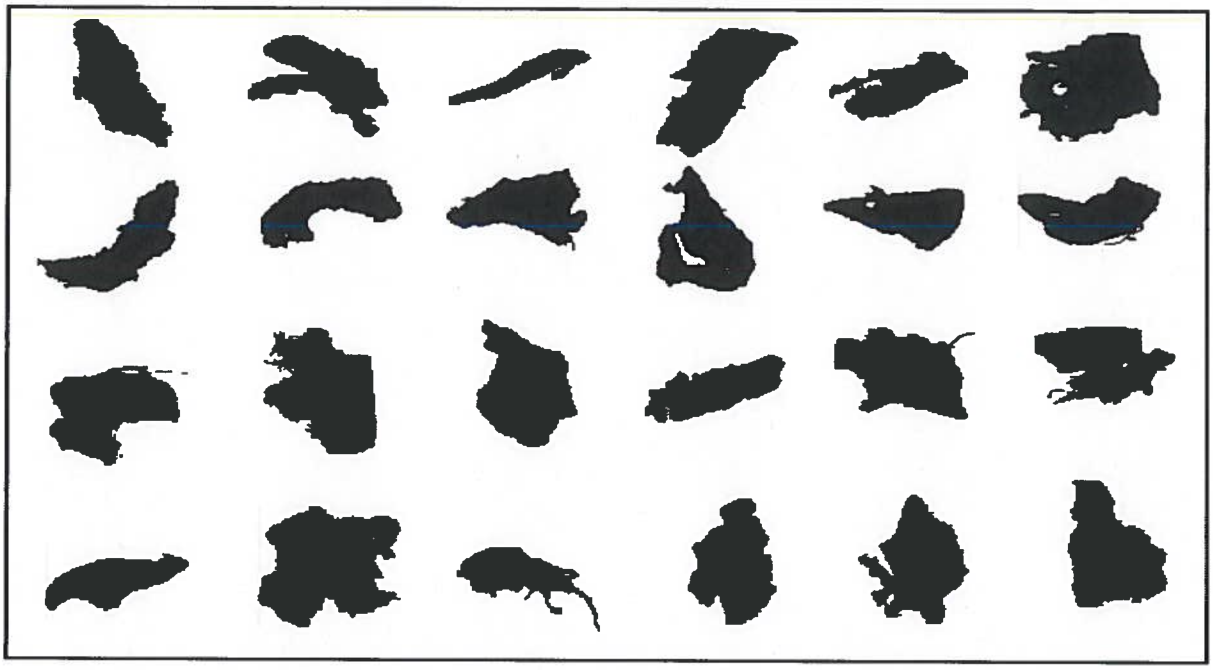

Ambient Rubber Infill Ref. Fr_3

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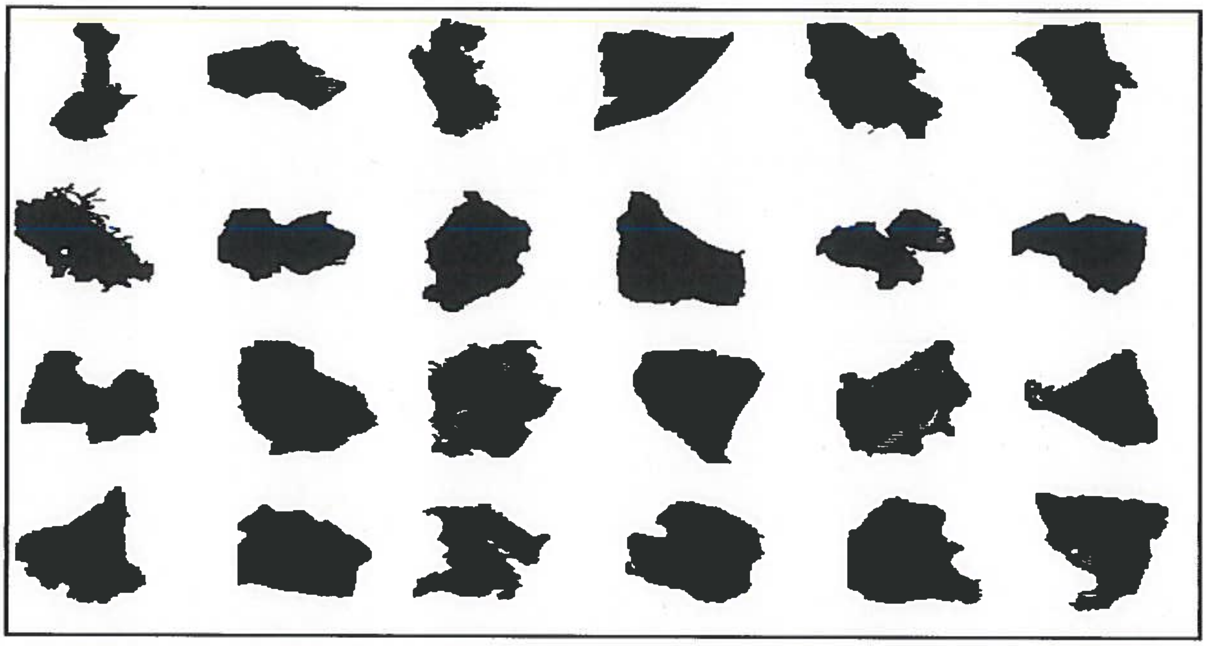
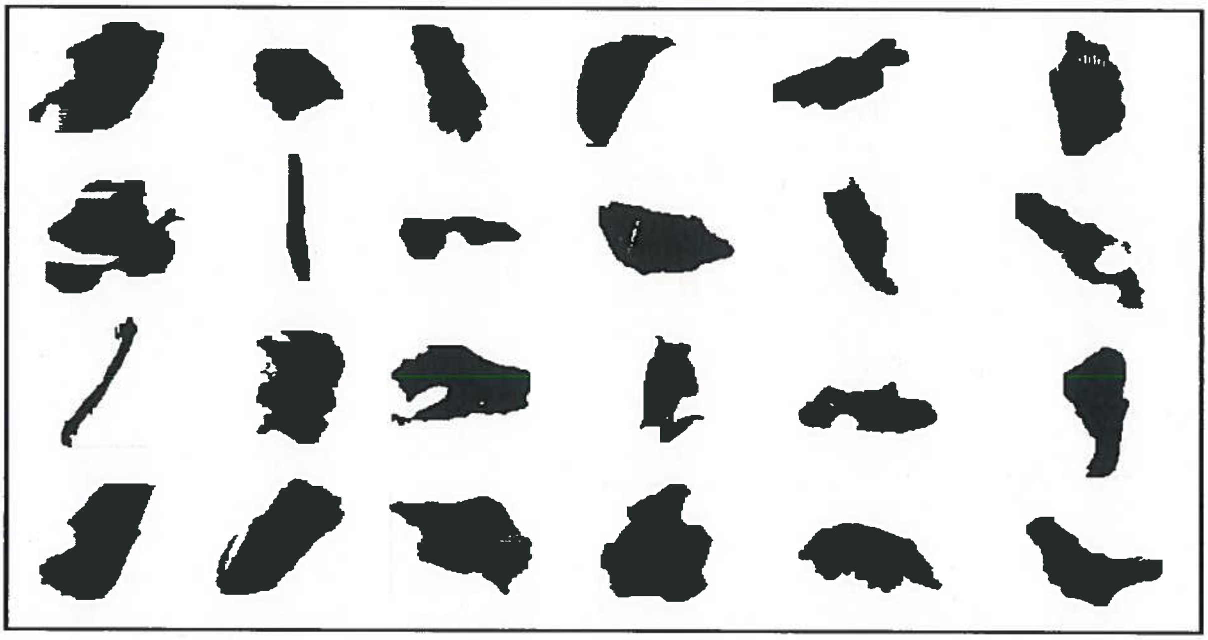


Ambient Rubber Infill Ref. Sp_1



Ambient Rubber Infill Ref. Sp_2

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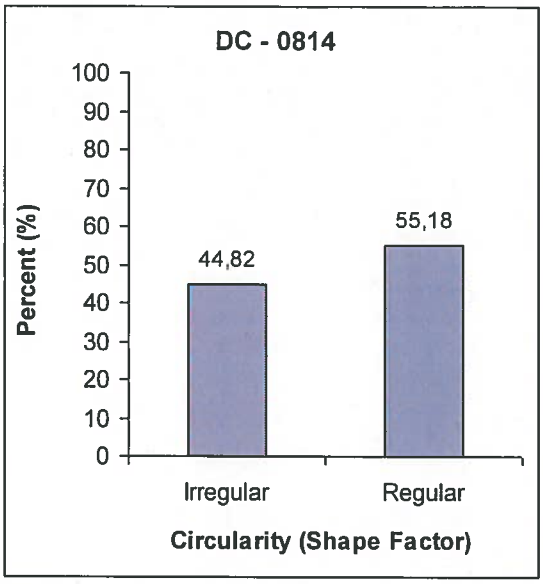
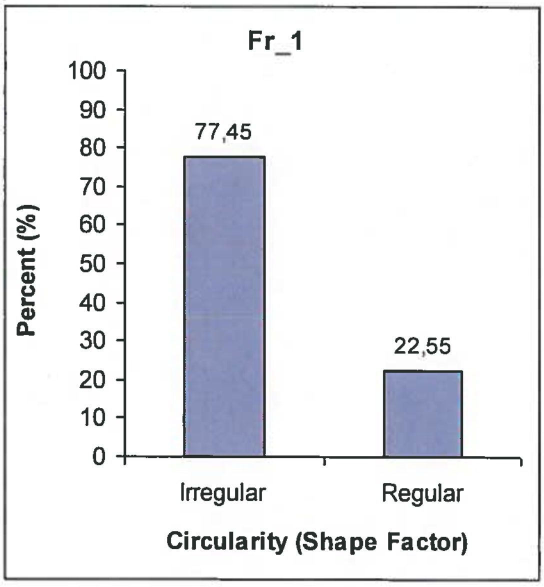
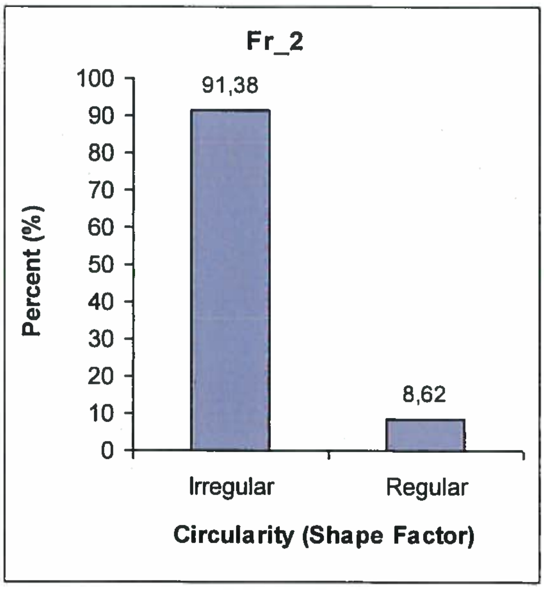
Shape Analysis – Circularity (Statistical Base)



Cryoflex ® *cryogenic rubber infill*
Ref. DC – 0814



Ambient Rubber Infill Ref. Fr_1



Ambient Rubber Infill Ref. Fr_2

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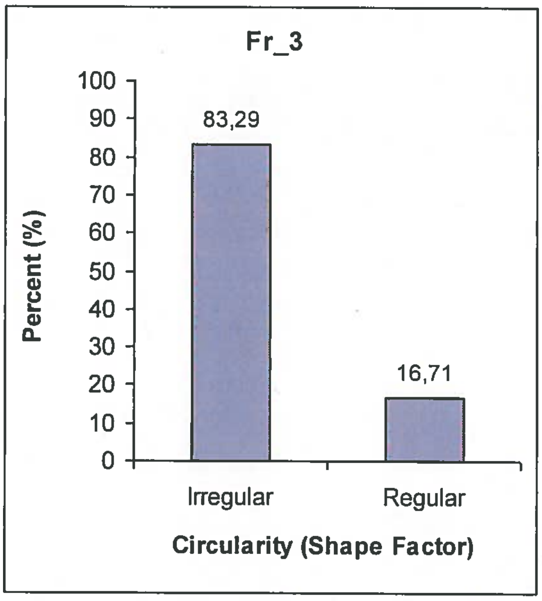
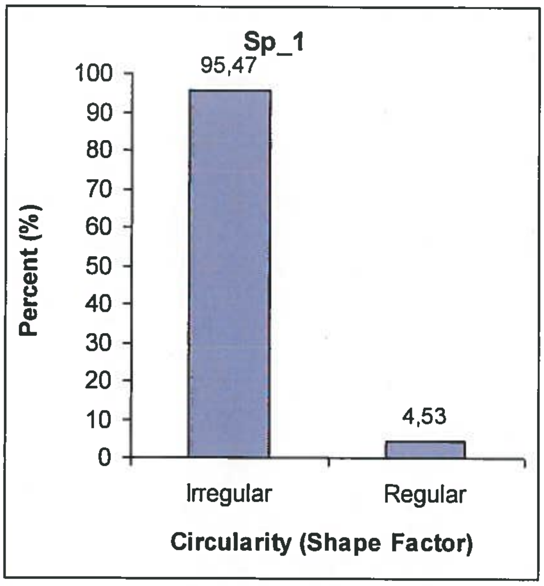
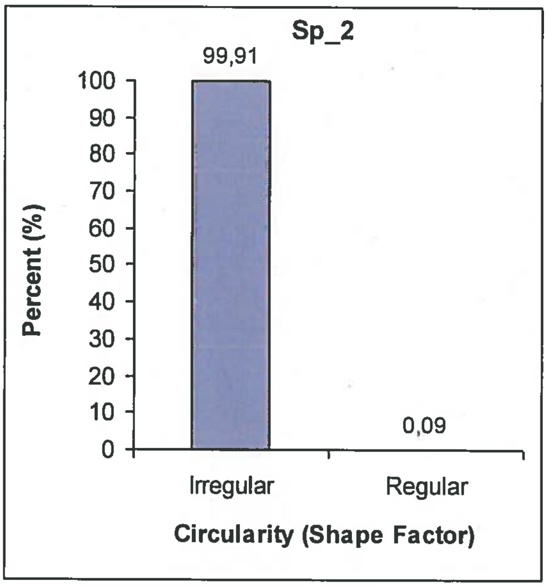


Ambient Rubber Infill Ref. Fr_3



Ambient Rubber Infill Ref. Sp_1



Ambient Rubber Infill Ref. Sp_2

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Circularity Definition

Circularity is a measurement of the ratio of the actual perimeter of a particle to the perimeter of a circle of the same area. A perfect circle has a circularity of 1, while a very 'spiky', irregular, or elongated object has a circularity closer to 0. Intuitively, circularity is a measure of irregularity or the difference from a perfect circle (sphere).

Conclusions

The rubber infill granulates that show the best compliance in shape factor are, no doubt, the **Cryoflex® *cryogenic rubber infill*** grades.

Mechanical (*ambient*) rubber infill granulates, obtained by different European suppliers, show very very irregular shapes.

From these very irregular and different shapes (linear, irregular, concave, polyhedral, etc.), very far from the "spherical/round" regular pattern, mechanical (*ambient*) rubber infill particles will bring to the artificial turf sport fields a very low abrasion resistance, and simultaneously a strong compaction factor of the rubber infill layer, as well a increased friction factor.

Moreover, the very high irregularity of the mechanical (*ambient*) rubber infill granulates in the rubber infill layer correspond, by their geometric adjustment, to a very low void space between the rubber particles, which, in addition to its strong compaction factor, bring the result of a very poor rain water drainage, sometimes with flooding, with the loss of rubber infill particles due to its floating behavior ("spongeous type" surface morphology, very high number of pores).
This is clearly a disadvantage, which will reflect negatively the durability of the artificial turf field, decreasing its playability, increasing its maintenance, and requiring frequent rubber refills.

Oppositely, **Cryoflex® *cryogenic rubber infill*** from RECIPNEU, show a very regular and "round to moderately angular type" shape profile, with a reduced compaction factor and friction factor, having an excellent rain water drainage corresponding to a very high void space content between the rubber particles in the infill layer, without flooding of the field or losses of rubber particles that don't float (any need of rubber refills), resulting in a increased playability with high durability and lower maintenance of the artificial turf field.

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Introduction

Regarding compaction and friction, we present below the important study "Behaviour of Cryoflex rubber infill in compaction and friction", by TNO and TenCate, showing compaction and friction behaviour of cryogenic and ambient rubbers with time. Also in this study it is evident the superior performance of **Cryoflex ®** cryogenic rubber infill. We refer this study because its conclusions can be understood and are related with the physical factors of size and shape described elsewhere in another study done by RECIPNEU.

Below we reproduce the study of TNO and TenCate.

Behaviour of Cryoflex rubber infill in compaction and friction

The specific functionality of the Cryoflex rubber introduced by the cryogenical grinding of the rubber scrap may have some improved properties with respect to the sport technical and durability parameters. Research has revealed that the shock absorbing and ball bounce properties are not affected by the way of grinding. However, the compaction of the rubber particles during use of the field and the friction between the rubber and a shoe shows some significant dependence on the different particle shape and size as produced by the grinding method.

Compaction

Since the introduction of the rubber filled artificial turf, a major aspect defining the durability of the field is the compaction of the rubber infill. A fast compaction may cause the infill layer to become hard in a short period of time, causing a change in shock absorption properties. The compaction behaviour of the Cryoflex is monitored in the Multiturf project by multiple loading of the test field by the Ten Cate "Destructor" (a sort of Lisport moving over a distance of 12 meter). This device containing two studded roles is moved across the field for 3000 cycles and the change in thickness of the infill layer is measured. The results of this measurement are shown in figure 1 and compared to ambient ground rubber scrap. The figure shows that the compaction of the cryogenically ground rubber is a slower process than that of the ambient ground rubber.

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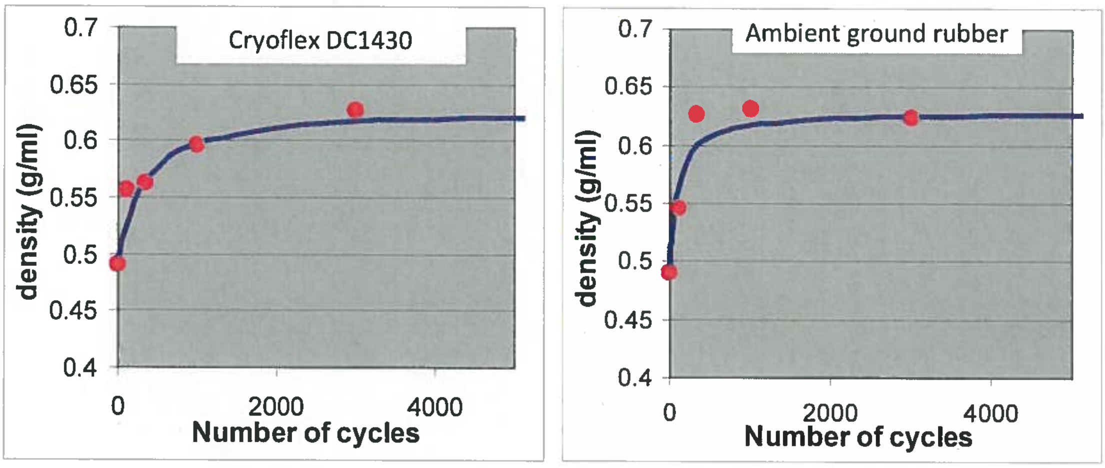

Figure 1: Increasing infill density of cryogenically (Cryoflex) and ambient ground rubber versus number of cycles

Friction

Another important aspect of a field is the amount of fixation of a shoe in the infill. This fixation is determined by the apparent friction coefficient between the studs and the rubber infill. This is assessed by TNO by measuring the force that is needed for one stud to plough through the rubber infill material. Two parameters have been evaluated: the stud height and the load that is applied to the infill during the ploughing of the stud through the infill. The results are shown in figure 2.

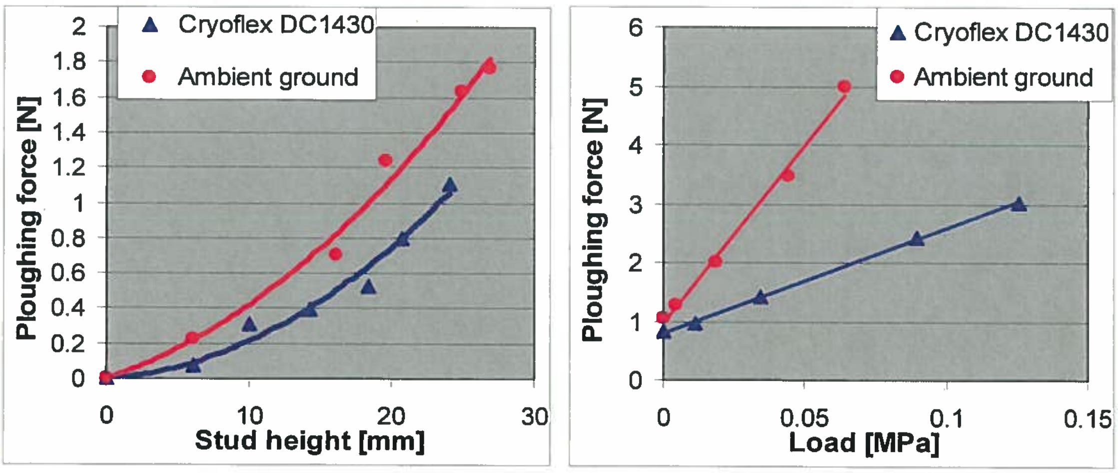

Figure 2: Ploughing forces of cryogenically (Cryoflex) and ambient ground rubber

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The two figures show that a higher force is needed for ploughing through ambient ground scrap than through the cryogenically ground rubber when the same size studs are used. Furthermore, if a load is placed on the infill, the ploughing force increases much more for the ambient ground material than for the *Cryoflex*. Both these experiments are an indication that the friction of a studded shoe in the *Cryoflex* is lower than in ambient ground SBR. This could be more pleasant for football players.

TNO and Ten Cate study, April 2008

Doc. 20.f.15

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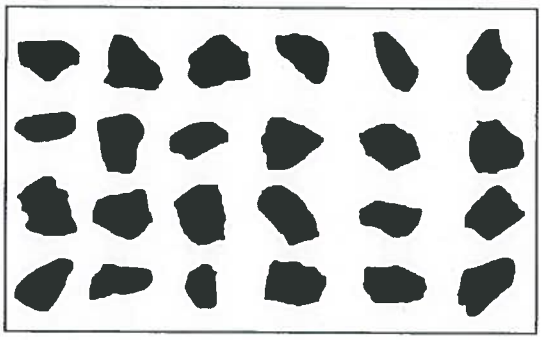
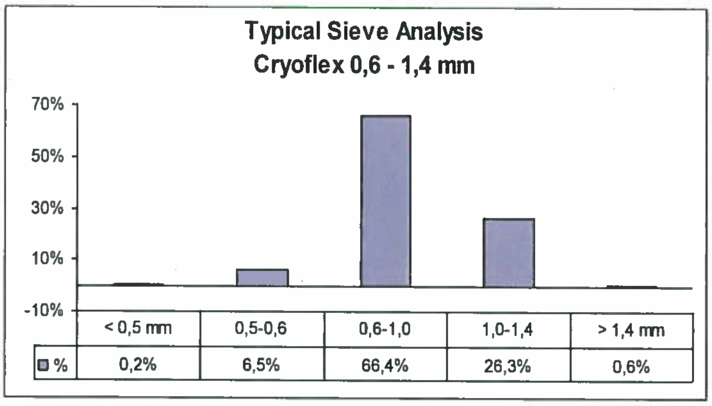
CRYOGENIC SBR TECHNICAL INFORMATION

Cryoflex® 0,6 – 1,4 MM

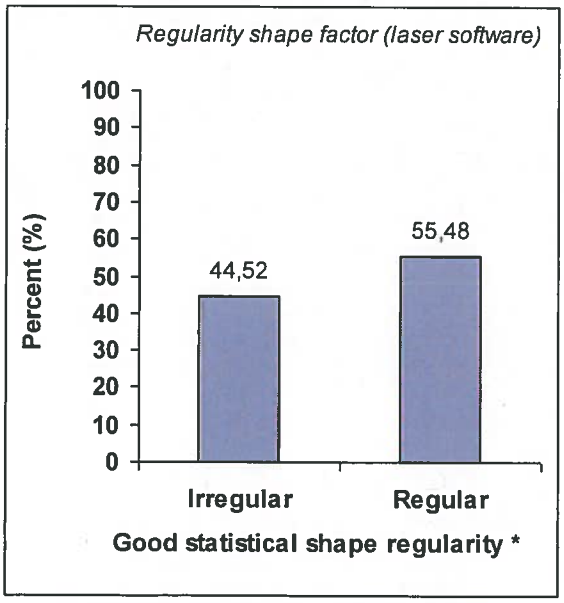
SBR cryogenic rubber infill
nominal particle size 0.6 / 1.4 mm

- **Main application: SYNTHETIC TURF**
- **Real photos of particles (laser image):**





- **Shapes and morphology of rubber particles:**
  Round, moderately angular (*ISA Sport*), smooth polished faces (practically without pores);
- **Statistical Index « Circularity »:**



(*) In non-cryogenic rubber infill the regularity factor is very reduced (less than 16%)

- **Density** (in bulk or application layer): 490 kg/m³ ;
- **Packaging:** Big-bag over wooden palette;
- **Leaching:** In compliance with the standards DIN - V 18035 – 7 (Fresenius Institute) and NF P90-112 (Labosport);
- **Rubber smell:** Negligible/ inexistent;
- **Release of fine inhalable particles PM2.5 and PM10:** Negligible (when compared with non-cryogenic rubber infill).
- **Chemical composition:** SBR and Natural Rubber compounds, the same used in tyre rubber compounds;
- **Production Process:** Cryogenic grinding technology, without causing friction and rubber heating therefore not imparting any chemical or thermal degradation in the original tyre materials, so they still keep the same innocuous condition for usage.
- **Abrasion:** Very high abrasion resistance (the round shape of the granulates, and its smooth morphology, confers to the rubber a very high resistance to fracture, regardless the force direction);
- **Compaction:** Very resistant to compaction (powder absence, and abrasion resistance);
- **Drainage:** Cryoflex® rubber infill layer is very permeable to water (high % of void spaces due to round shapes and absence of powder and compaction) so, the synthetic field never remains flooded, even in the case of very heavy rain.
- **Durability and performance:** Very much extended.

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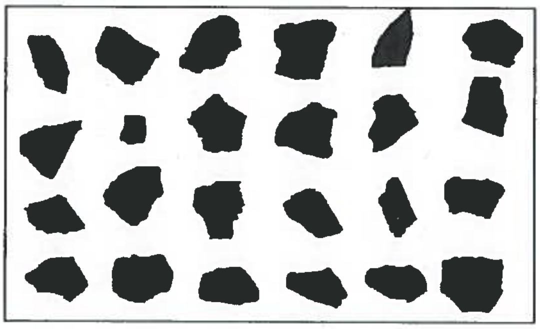
FICHE TECHNIQUE SBR CRYOGÉNIQUE

Cryoflex® DC-0814 (1 – 2,4 mm)

Granulat de caoutchouc SBR produit par la Technologie Cryogénique, de granulométrie nominale 1 / 2,4 mm (« *Cryoflex®DC-0814* »)

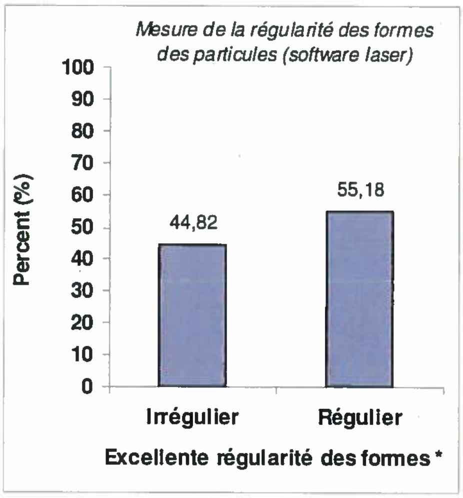
- **Application principale : Gazon Synthétique**
- **Photos réels du Produit (*image laser*) :**



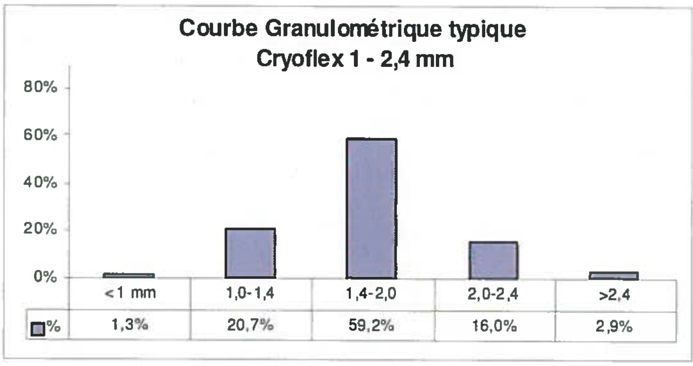
- **Formats des particules de caoutchouc :**

Rondes, modérément angulaires (*ISA Sport*)

- **Index Statistique de « Circularité » :**



(*) Dans les granulats de caoutchouc non cryogéniques la Régularité est très faible (presque toujours inférieure a 16 %).



- **Densité (en vrac ou couche d'application): 460 Kg/m³ ;**
- **Conditionnement : Big-Bag sur palet ;**
- **Lixiviations : Conformité total avec les deux Normes NF P 90-112 (*Labosport*) et DIN-V 18035-7 (*Fresenius Inst.);***
- **Odeur du caoutchouc : négligeable/inexistante ;**
- **Pas de libération de particules inhalables (PM2.5 et PM10) ;**
- **Composition Chimique : polymères de caoutchouc SBR et Naturel dans les formulations de composition des pneus ;**
- **Procédé de fabrication : Technologie Cryogénique de broyage des pneus, sans friction et réchauffement du caoutchouc, donc sans provoquer dégradations moléculaires chimiques ou thermiques sur le matériel original des pneus, et qui procure par conséquent au produit une bonne innocuité a l'utilisation ;**
- **Abrasion : Très résistant à l'abrasion (la forme des granulats essentiellement rondes, et pas du tout filiformes, confèrent au caoutchouc une très haute résistance à la rupture, et ce quelque soit la direction des forces exercées) ;**
- **Compaction : Très résistante à la compaction (absence de poudrettes, et résistance á l'abrasion) ;**
- **Drainage : La couche de granulats de caoutchouc *Cryoflex®* est très perméable à l'eau (haute % d'espaces vides à cause de formes rondes, de l'absence de poudrette, et de phénomènes de compaction), donc le terrain de jeux ne reste jamais inondé, même en cas de très fortes pluies ;**
- **Durabilité et Performance en terrains de jeux : Très élevées.**

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UNITED WE STAND IN 2007

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ENVIRONMENTAL ASSESSMENT (LEACHING AND GAS EMISSIONS) OF INFILLED SYNTHETIC TURF

RESEARCH SET UP BY A FRENCH LABORATORY (EEDEMS) IN PARTNERSHIP WITH THE FRENCH ENVIRONMENTAL AGENCY (ADEME), FIELDTURFTARKETT AND ALIAPUR (Association in charge of collecting old tires and their reuse)

eedems
évaluation
environnementale
déchets, matériaux
et sols pollués

FieldTurf Tarkett
UNITED IN SPORT

ALIAPUR

ADEME

FieldTurf Tarkett
UNITED IN SPORT

ENVIRONMENTAL AND HEALTH RISK STUDY FIELDTURF TARKETT

- This study has been carried out to achieve different goals :
  - Give scientific information regarding environmental impact of our systems
  - Bring scientific answers to people's questions on the market
  - Compare different infill materials to shut down polemics from competitors using EPDM and TPE
  - Give bases for new protocol measurements

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EEDEMS: A SCIENTIFIC GROUP OF INTEREST SPECIALIZED IN RISK ASSESSMENTS FOR BUILDING APPLICATIONS USING RECYCLING MATERIALS

French technological platform of environmental impact assessment of water / polluted soils / materials

- INSA LYON
- ENTPE
- CSTB le futur en construction
- brgm Géosciences pour une Terre durable

4 publicly-owned establishments and 6 teams of research

Towards a pluridisciplinary consideration of eco-compatibility and treatment and reuse networks life cycle

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EEDEMS SET UP A COMPLEMENTARY APPROACH TO THE TESTS STANDARDIZED IN LABORATORY IN ACCORDANCE WITH THE EN 12920 STANDARD AND THE WORK OF TC 351 (CONSTRUCTION)

Environmental and Health Assessments through the study of :

A : Chemical and Ecotoxicologic analysis of water passing through synthetic turf (following EN 12920)

B :

- ✓ VOC and Aldehydes emissions generated by materials used in synthetic turf (following a new protocol for construction products (TC 351))
- ✓ Health risks according to several scenarios

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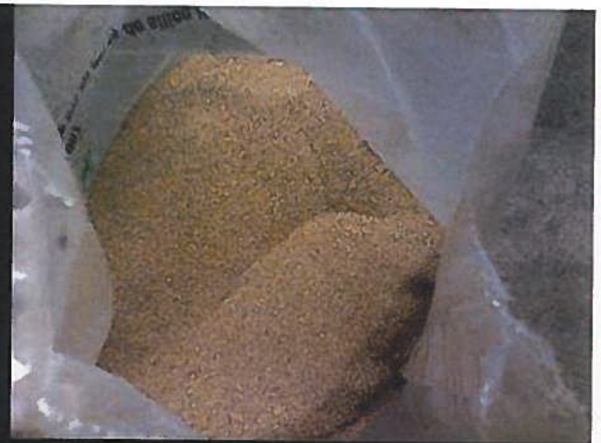
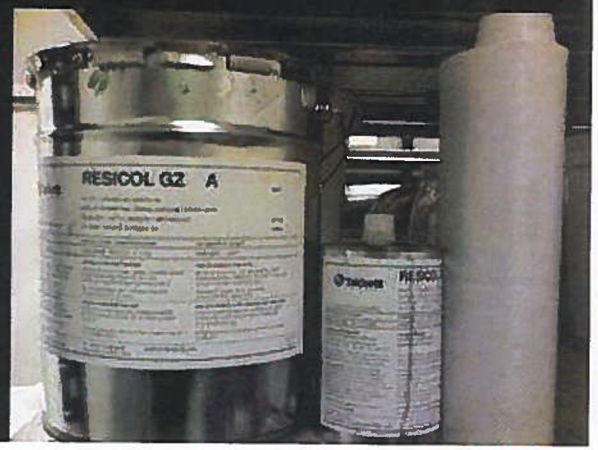
MAJOR CONSTITUANTS OF STUDIED SYSTEM

Synthetic Turf product from the FieldTurf Tarkett range



Sand washed SIZE<1 mm

Granulates (0,5 – 2 mm) : EPDM, TPE, SBR



Synthetic seaming tape and adhesive polyurethane

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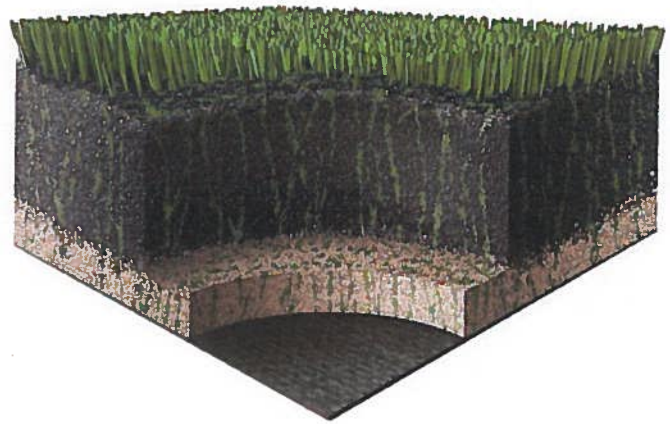
ENVIRONMENTAL ASSESSMENT OF SYNTHETIC TURF : LEACHING

1 – Fieldturf Tarkett Product



2 - Methods

✓ <u>Two different approaches</u> :

- on site, with a real outdoor synthetic field, near LYON (France)
- in an experimental room of EEDEMS Laboratory located in Lyon

✓ <u>Two types of instrumentation</u> :

- on site, with a water collecting system implemented under the synthetic turf during the installation process
- in the lab, with four experimental reduced scale synthetic turf pitches

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INSTALLATION OF A WATER COLLECTING SYSTEM (LYSIMETER) UNDER REAL OUTDOOR SYNTHETIC TURF NEAR LYON

Installation of the water collecting unit

Adjustment of the levels

Water collecting system

Adjustment of the ground draining support

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INSTALLATION OF SYNTHETIC TURF ABOVE THE WATER COLLECTING SYSTEM – RUBBER GRANULATES AS INFILL MATERIAL

Unfolding of a roll of synthetic turf

Installation of the roll of synthethic turf above the water collecting unit

Spreading and brushing SBR all over the field

Discharge of SBR to the top of the water collecting unit

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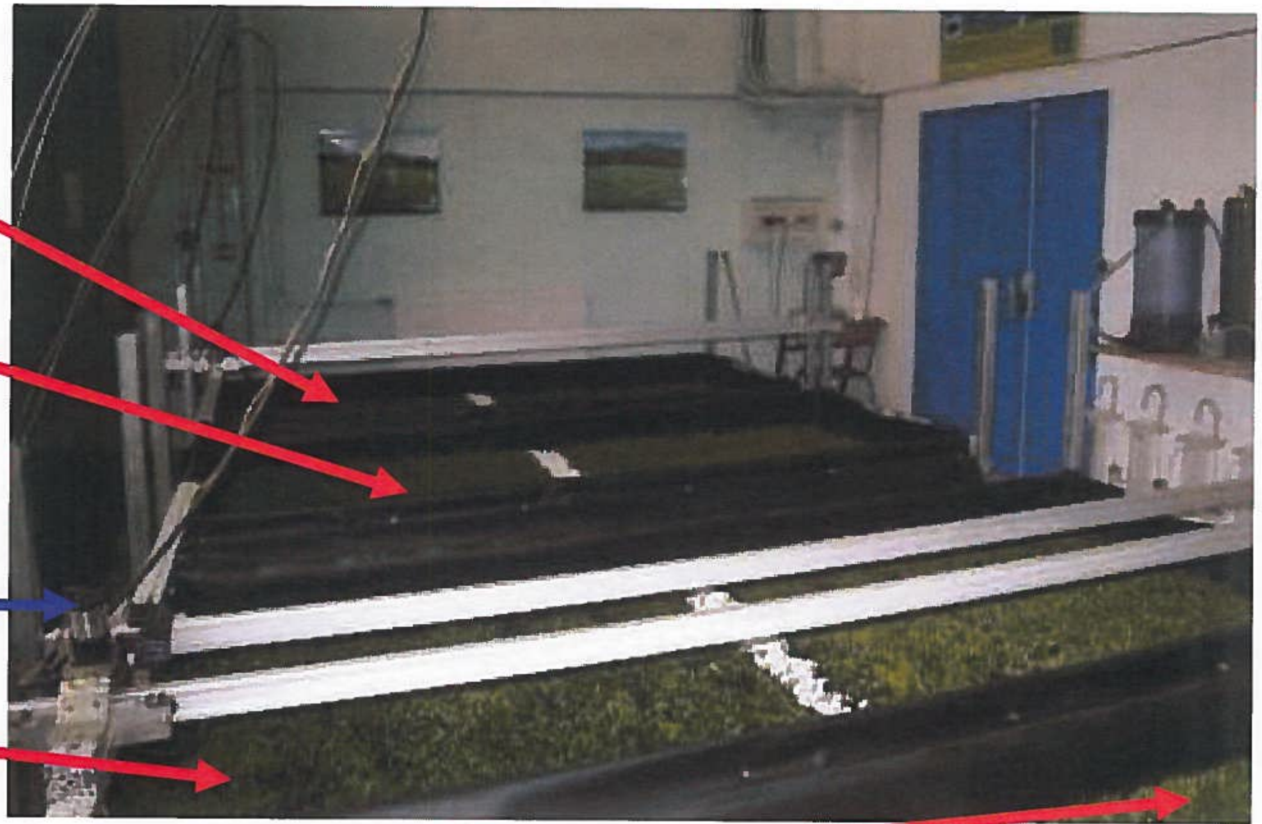
CONSTRUCTION OF 4 REDUCED SCALE INDOOR SYNTHETIC TURF PITCHES, ARTIFICIALLY WATERED



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THE EXPERIMENTATION HAS BEEN RUNNING FOR 12 MONTHS WITH FREQUENTLY SAMPLING FOR ANALYSIS

✓ On Site approach-Outdoor field

- Beginning : October 2005
- 7 samples and analysis from October 2005 to October 2006 (depending on rain levels)
- End of the experimentation : October 2006

✓ The 4 experimental Indoor reduced scale synthetic turf pitches

- Beginning : November 2005
- 8 samples and analysis from November 2005 to October 2006 (after 15 days, 1, 2, 3, 6 months)
- End :October 2006

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PHYSICOCHEMICAL ANALYSIS OF SAMPLES AND COMPARISON WITH LEGAL LIMIT VALUES

43 parameters analyzed :

- pH and conductivity
- Organics :
  - Total Hydrocarbons (THC)
  - Polycyclic Aromatic Hydrocarbons (16 PAHs)
  - Total Organic Carbon (TOC)
  - Phenol
- Metals : Al, Ba, Cd, Co, Cu, Mo, Ni, Pb, Sb, Se, Zn, As, Cr, Hg, Sn
- Fluorides, Chlorides, Sulfates
- Ammonium
- Nitrates

Compared to :

- Limit values as defined by the European Standards for non dangerous waste disposal
- Limit values according to the Classified Installation for Environmental Protection decree
- The French Acceptance levels for drinkable water (decree 2001-1220)

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RESULTS

A : Chemical and Ecotoxicological analysis of water passing through synthetic turf (according to EN 12920)

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Results for chemical analysis

✓ pH and conductivity similar between outdoor collected samples and indoor pilot reduced scale fields

✓ Organics :
Very low concentrations measured for each component and always under limit values
Cyanides : < 60 µg/l
Phenol : < 20 µg/l
Hydrocarbon : < 50 µg/l
6 PAHs : < under detection limits

✓ Heavy Metals
Very low concentrations measured for each component and always under limit values

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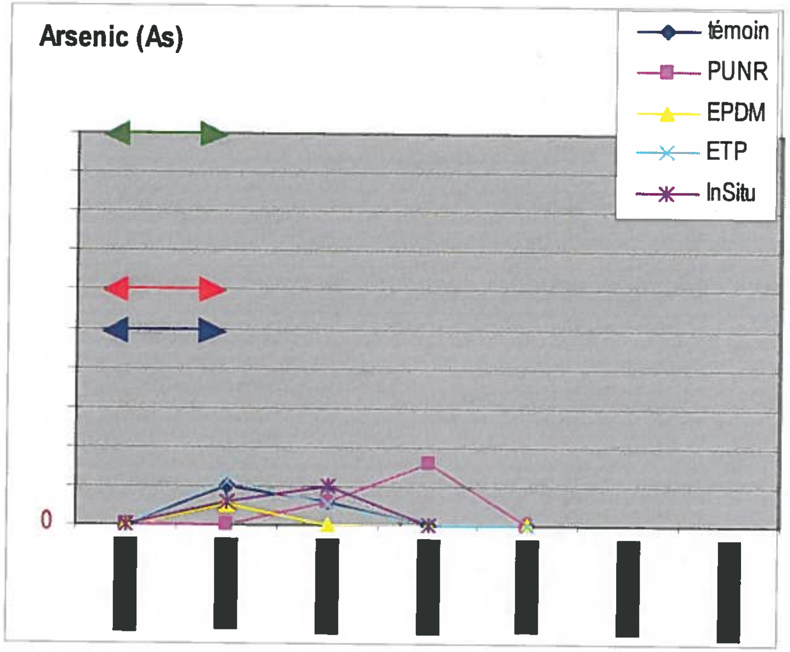
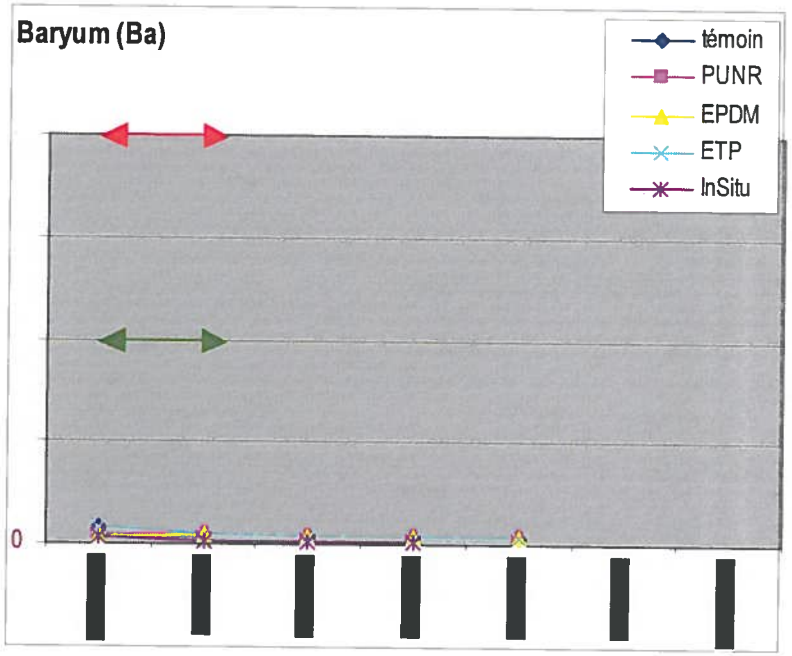
✓ HEAVY METALS

Arsenic



Limit of legal values

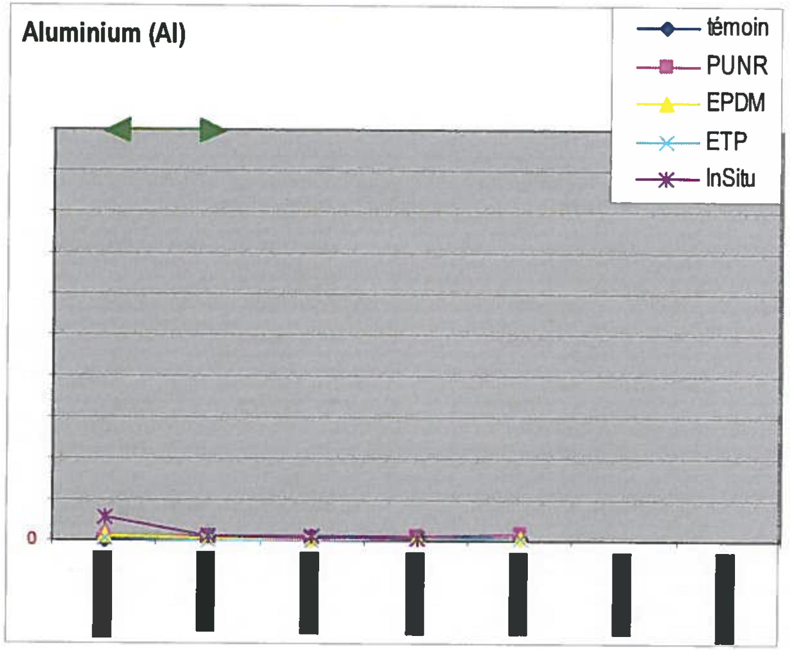
Barium



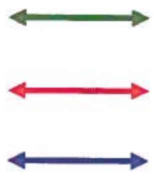
- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

✓ HEAVY METALS

Aluminum

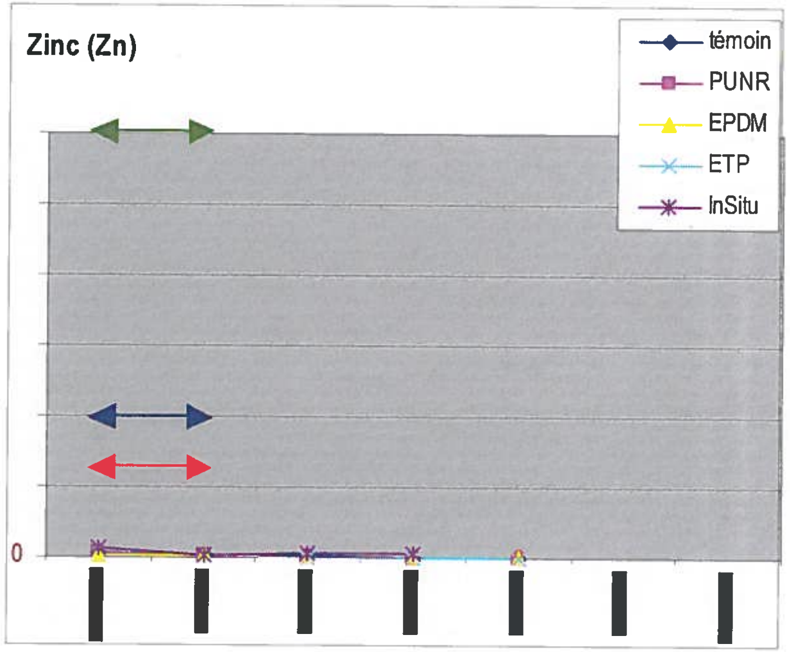


Limit legal values



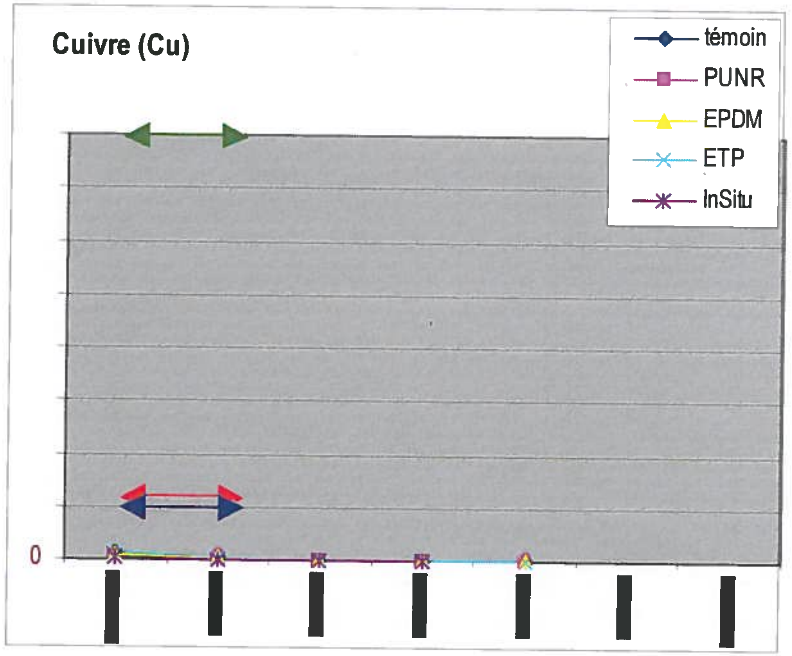
- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

Zinc



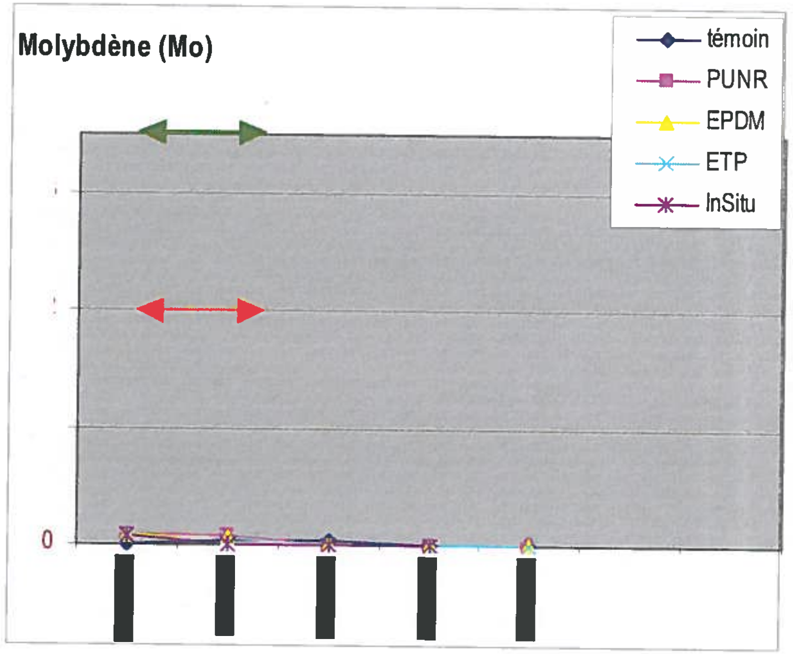
✓ HEAVY METALS

Copper



Limit legal values

Molybdenum



- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

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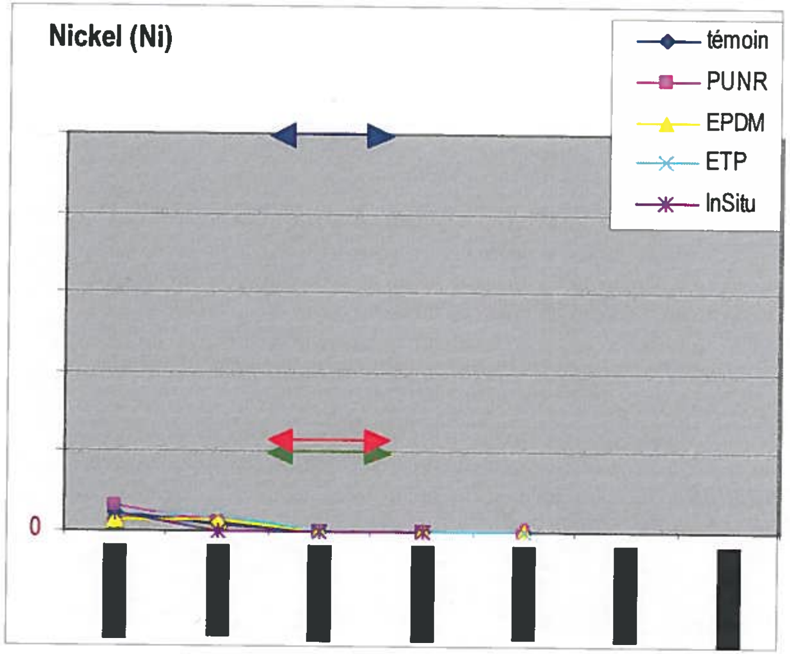
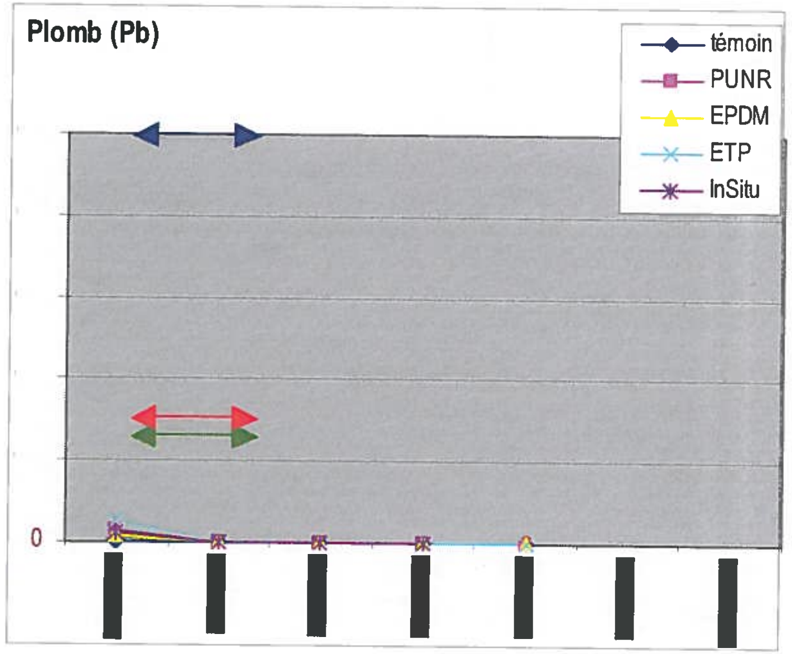
✓ HEAVY METALS



Limit legal values

Plumbum



- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

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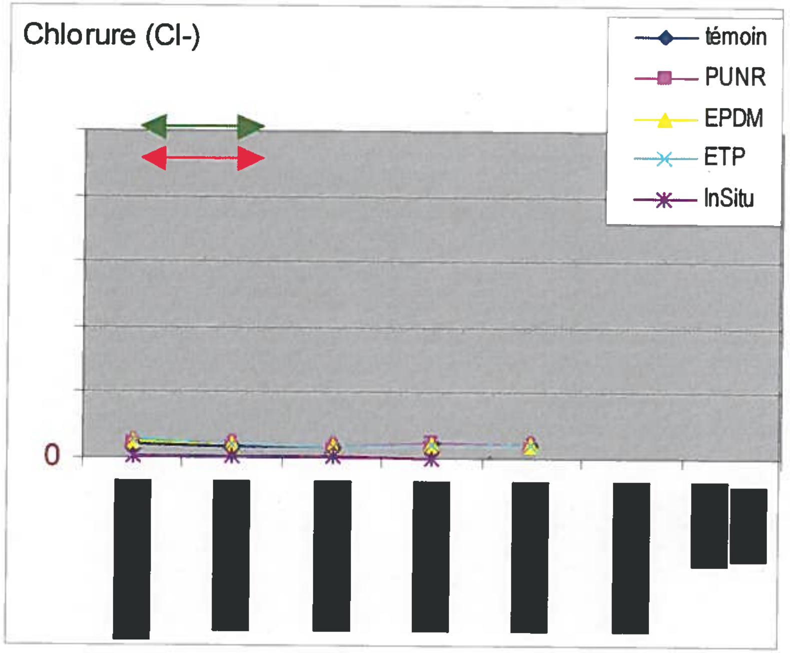
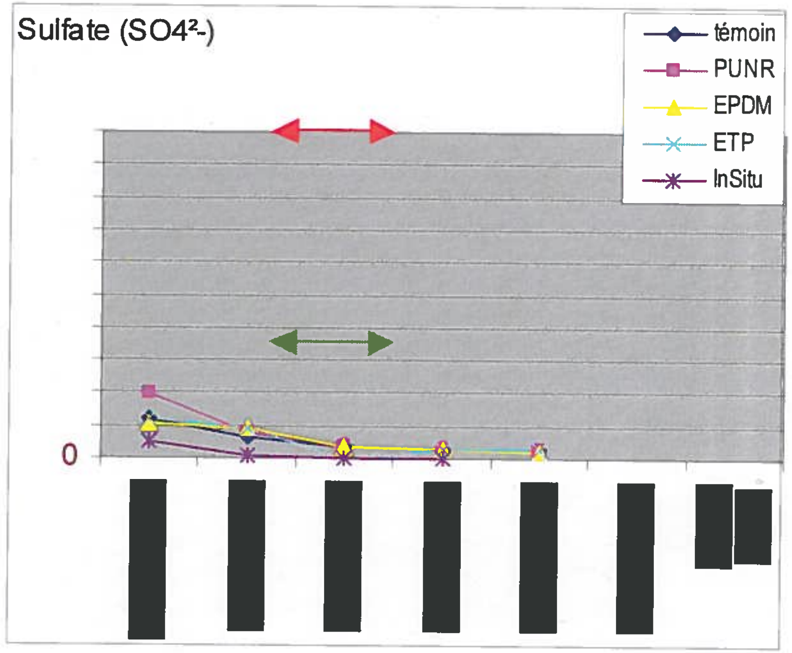
✓ Chlorites, Sulfates, Fluorites

Chloride



Limit legal values

Sulphate



- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

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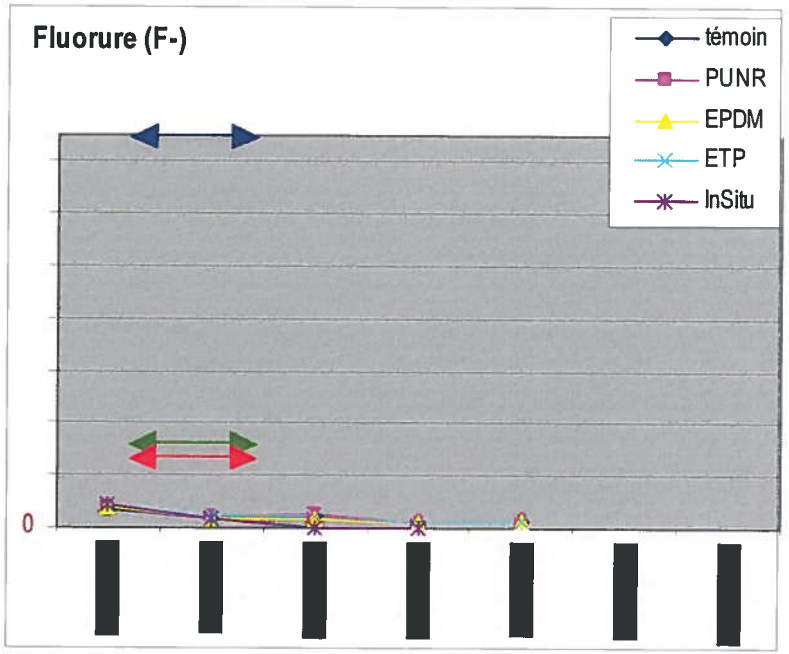
Fluoride



Limit legal values

- Synthetic fibers
- Rubber granulates from tires
- EPDM granulates
- ETP granulates
- Rubber granulates (in situ)

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✓ TOXICOLOGICAL TESTS

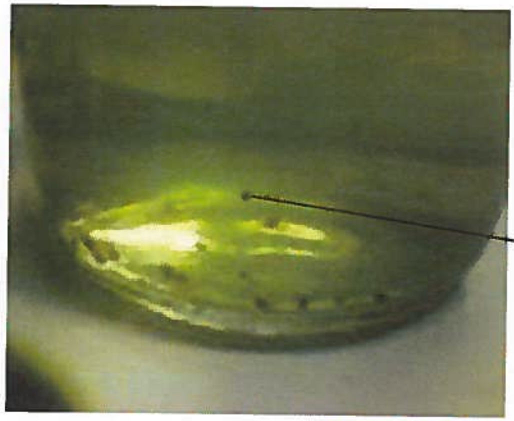
Determination of acute toxicity (inhibition of the mobility of Daphnia magna

+

Evaluation of the chronic toxicity (inhibition of the growth of the algae *Pseudokirchneriella subcapitata*)

→ **No observed toxicity**

→ **The value never exceeded the usual level of toxicity**



No toxic answer observed in acute (*Daphnia magna* 24h)

No toxic answer observed in chronic (*P. subcapitata* 72h)

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CONCLUSIONS OF THE LABORATORY

A : Chemical and Ecotoxicologic analysis of water passing through synthetic turf (following EN 12920)

- **Equivalent results** for all the different materials regarding legal levels :
  - For samples collected on the Outdoor synthetic pitch
  - For samples collected in the experimental room

- Concentrations in collected water are **always under the limit values and sometimes even under the detection limits**.

- **No observed toxicity**

Notice that the quantities of the tested materials are one hundred times more important in this study than in all existent studies (20 to 30 kg compared to 10 to 200 g) so as to offer the best representativeness

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EEDEMS SET UP A COMPLEMENTARY APPROACH TO THE TESTS STANDARDIZED IN LABORATORY IN ACCORDANCE WITH THE EN 12920 STANDARD AND THE WORK OF TC 351 (CONSTRUCTION)

Environmental and Health Assessments through the study of :

A : Chemical and Ecotoxicological analysis of water passing through synthetic turf (following EN 12920)

B :

- ✓ VOC and Aldehydes emissions generated by materials used in synthetic turf (following a new protocol for construction materials (TC 351))
- ✓ Health risks regarding several scenarios

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ASSESSMENT OF THE GAS EMISSIONS

Characterization of the VOCs emissions and aldehyde

Preparation of the samples

Samples in the chambers of tests

Chambers of tests

Emission test chambers

- VOCs measure:

  NF ISO 16000-6

- Formaldehydes measure:

  NF ISO 16000-3

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ASSESMENT OF THE GAS EMISSIONS

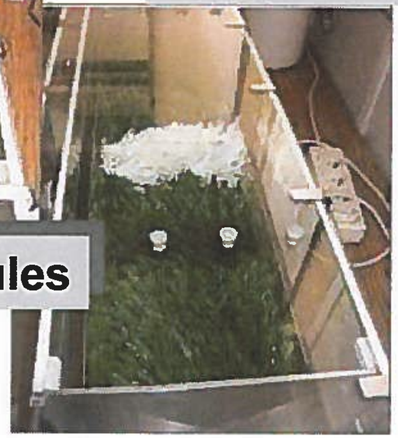
Preparation of the samples and conditioning in emission test rooms → Day 1 → Day 3 → Day 28

Day 1, Day 3, Day 28 → 3 measurements

Recycled Rubber granules from tires

TPE granules

EPDM granules



Synthetic fibres

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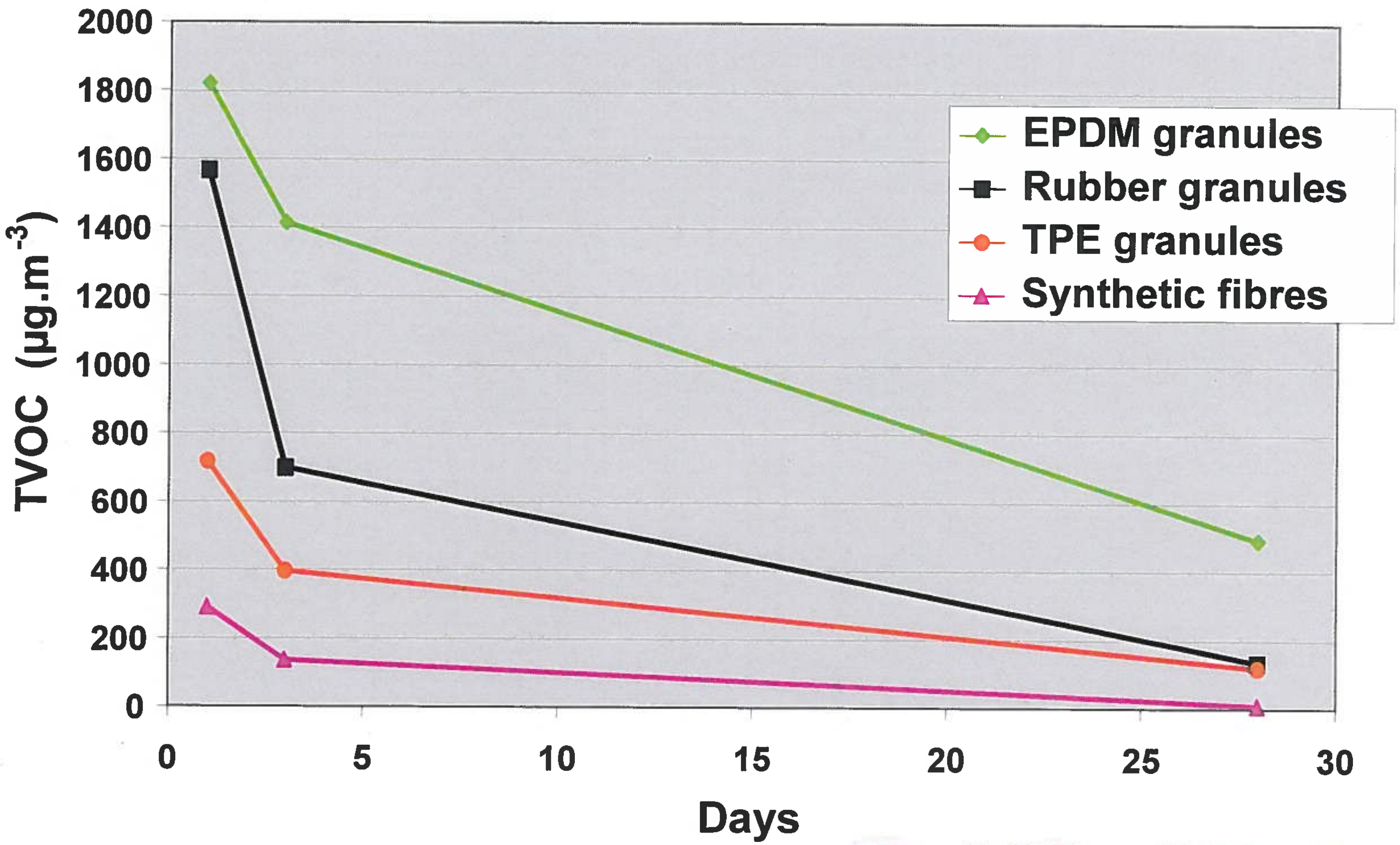
ASSESSMENT OF GAS EMISSIONS RESULTS



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ASSESSMENT OF THE GAS EMISSIONS
FIRST COMMENTS

- Very low emissons for synthetic fibres (reference sample)

- Rubber granules, TPE granules and EPDM granules :

  - Low emissions comparable to known building materials

- NEXT STEP : ASSESSMENT OF THE HEALTH RISKS BASED ON INDOOR EXPERIMENTAL MEASUREMENTS (Day 1, Day 3, Day 28)

  - Extremely complex measurements for outdoor fields (variable parameters)

  - The Mathematical models estimate people's exposure when they are distanced by 100m of the emissive surface

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EVALUATION OF THE HEALTH RISKS BASED ON INDOOR GAS EMANATIONS MEASURMENTS

Evaluation carried out by INERIS (National Institute of Health Risk Evaluation)

WORST CASE SCENARIO

- Small Indoor field with a very low air renewal atmospheric ratio

-2 types of exposition (acute and chronic)

-4 different scenarios analysed by type of exposure :

  -Installers

  -Professional players

  -Non Professional Players

  -Spectators

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ASSESSMENT OF THE HEALTH RISKS BASED ON INDOOR GAS EMANATIONS MEASURMENTS

	Acute exposition	Chronic exposition
INSTALLERS	Gas emanations of Day 1	8h per day//70 days per year Gas emanations of Day 1
PRO PLAYERS	Gas emanations of Day 3	8h per day//365 days per year Gas emanations of Day 28
NON PRO PLAYERS	Gas emanations of Day 3	10h per week//44 weeks per year Gas emanations of Day 28
SPECTATORS	Gas emanations of Day 3	Present at every match Gas emanations of Day 28

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ASSESSMENT OF THE HEALTH RISKS BASED ON INDOOR GAS EMISSIONS MEASUREMENTS
CONCLUSIONS AND RECOMMENDATIONS

- For several VOC and aldehydes, modelised concentrations with measured gas emissions are comparable to typical atmospheric air concentrations
- No health risk caused by identified components and their concentrations in our worst case scenario whatever the infill
- No health risk caused by the use of infilled synthetic turf in an Indoor environment for players
- Thus no health risk caused by the use of infilled turf in an outdoor environment
- *Recommendation : For the safety of installers, it is necessary to have a renewal atmospheric ratio of > 2 vol/h in very small rooms*

GENERAL CONCLUSION

- This complementary approach gives scientific information on the environmental impact of the different infilled synthetic turf systems found on the market.
- This study aims at being an outstanding reference on the market

- Our system based on recycled tire rubber granules has no impact whatsoever on the environment and no health risk for the users

- Whatever the infill (SBR, EPDM or TPE) the results are very similar (leaching, gas emission and health risks)

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Availability of Study results for Communication/ Sales Support

1st of February 2007

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UNITED WE STAND IN 2007

RECIPNEU

Cryoflex® *cryogenic rubber infill*
Recycled tyre rubber granulates produced and supplied for infilling synthetic turf sport fields

Year	Rubber infill sales (metric tons)
2001	2.170
2002	3.243
2003	4.815
2004	5.324
2005	7.640
2006	6.616
2007	7.379
2008	4.471
2009	8.737
2010	7.450
2011	5.168
2012	2.151
2013	2.528
2014	4.830
2015	4.850
2016	6.161
2017	6.300 (est.)
Total	**89.833**

INSTITUTO SUPERIOR TÉCNICO

Doc. 20.f.20

Weigeringsgrond 10.2.e

EXAMINATION ON E.L.T. GRANULATES

"End of Life Tire" Granulates are largely composed by SBR granules with minor amounts of other rubber types.

The Average content of Aromatic oils used as plasticizers is progressively lower from year to year since those oils have been replaced several years ago, and consequently the observed content of traces of PAH is also lower from year to year.

E.L.T. granulates have been used with success on Playground aggregated rubber tiles and as infill material in artificial football grounds, for more than 20 years without any reported damage on the health of the users.

The examination to be conducted should focus on the **Exposure** and not on the PHA content in the rubber, since SBR as well as other rubbers are crosslinked polymers with rather low free volume and therefor the PHA molecules are trapped in the macromolecular structure and the presence on the surface is very often non detectable.

PHA molecules are Hydrophobic, and the leaching by the rain water is not observed, and the transfer to the Skin by contact is also not observed despite the several attempts made in the past to quantify, as reported in the attached publications.

Exposure and not **Content** seems therefor to be the right way to be adopted as criteria for the evaluation since as in several other cases the content is irrelevant and meaningless.

Several other examples where the Content is irrelevant can be found in everyday life, as in the following ones:

Example 1

Forks and knives we use every day to eat at the table have around 18% Chromium, and this means 180 000 p.p.m. of this well-known heavy metal.

Example 2

Elastomeric Aliphatic polyurethanes, with a behavior very similar to rubber, are often used to produce artificial veins for transplant surgery despite the fact that isocyanates are used as raw materials. Very often the Isocyanate is used in stoichiometric excess, and since the reaction is second order traces of isocyanate remain for extended periods of time inside the elastomeric structure, **but not leach to the internal body fluids.**

Example 3

Leather manufacture uses Chromium as well as Phenolic compounds as tanning agents, and rather high content of those toxic compounds remain in the final leather. In the everyday life, the leather loses, very slowly the aliphatic oils, similarly with what happens in the rubber, but, similarly with what happens with the rubber, the toxic compounds are entrapped in the macromolecular structure in contents of several hundred p.p.m. and **do not leach to the skin by contact**.

Exposure is therefore the adequate criteria to access the potential health risk instead of the content of dangerous substances inside the material under observation.

Lisbon, IST on 20 December 2016

[redacted]

EUROPEAN TYRE & RUBBER manufacturers' association

Doc. 20.g.1

13/10/2017

ETRMA reply to

Call for evidence on PAHs in plastic and rubber granulates used as infill material in synthetic turf pitches

1: Please provide information on the concentrations of PAHs in plastic or rubber granulates used as infill material in synthetic turf pitches you are producing or importing. In case you have taken samples from pitches, please provide the measurement data. Do you have information on how the rubber granulates changes during use (e.g. changes in the composition after 10-15 years)? (If you have already submitted such information during the preparation of the preliminary report by ECHA, there is no need to resubmit this information.)

In partnership with FoBig – a expert risk characterization consultant – ETRMA and CRIP (*Crumb Rubber Industry Platform)* launched the project on the *"Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF)"* (called hereunder FoBig study) earlier this year. More than 50 samples of *recycled crumb rubber from end-of-life tyres* (hereafter called ELT – derived rubber) will be collected, including samples of crumb rubber from recycling plants and directly from fields with STF from outdoor and indoor facilities.

The study will characterize the content of the eight PAHs referred to in entry 50 of the REACH legislation and other substances that are suspected to be present in STF from literature review. As no established and accepted method of measurement of the content of PAH is available, the DIN ISO 12884 standard with elution with Cyclohexane/Toluene will be applied for the determination of the content of PAH in ELT – derived rubber. The first results on PAH content from the Fobig study are expected by February 2018.

Comparable results on the content of PAH in crumb rubber require an established and accepted method of measurement. We encourage authorities to consider data on PAH content on rubber crumb that use well known and recognized measurement methods. Further, in view of setting restriction criteria on the content of PAH in infill of STF, **authorities should introduce an internationally harmonized standard for measuring PAHs.**

Currently, and until the Fobig study is ready, ETRMA estimates that the content of PAH in ELT-derived rubber may be in a range of up to 20 ppm, slightly varying between the origin of tyres, as seen is the table hereunder.

Table 1 – PAHs in ELT-derived rubber granulates*

ppm		Mean	Min	Max
sum of 8	**Total**	**12**	**4**	**20**
restricted	T&B	11	4	18
PAHs*	Mix	12	4	20
	OLD	12	4	20
	NEW	11	4	19
	Unsorted	8	6	10

***PAH:** *(a) Benzo[a]pyrene (BaP) CAS No 50-32-8 (b) Benzo[e]pyrene (BeP) CAS No 192-97-2 (c) Benzo[a]anthracene (BaA) CAS No 56-55-3 (d) Chrysen (CHR) CAS No 218-01-9 (e) Benzo[b]fluoranthene (BbFA) CAS No 205-99-2 (f) Benzo[j]fluoranthene (BjFA) CAS No 205-82-3, (g) Benzo[k]fluoranthene (BkFA) CAS No 207-08-9 (h) Dibenzo[a,h]anthracene (DBAhA) CAS No 53-70-3*

Source: *Andrea Re Depaolini, Giancarlo Bianchi, Daniele Fornai, Angela Cardelli, Marco Badalassi, Camillo Cardelli, Enrico Davoli, Physical and chemical characterization of representative samples of recycled rubber from end-of-life tires, In Chemosphere, Volume 184, 2017, Pages 1320-1326, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2017.06.093. (http://www.sciencedirect.com/science/article/pii/S0045653517309967)*

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Legend: T&B= 100% truck and bus tyres, Mix: from 8:92 to 70:30 mixes of T&B/PCT, PCT: Passenger Car tyres
Old= Production ante 2010, New= Production post 2010, Total: 25 samples, Unsorted= crumb rubber from 5 recycling facilities

Regarding the effects of aging in crumb rubber used in STF, at this stage, there are no reasons to link effects of aging with the content of PAH. During the use of crumb rubber in STF, VOCs might be potentially generated, for instance phenol, formaldehyde, ethanol or methanol - (more information is available on the comments already submitted to ECHA in the context of preparing the report on *"An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields."*, Version 1.01 of February 2017- and attached to this CoE for your convenience)

The Fobig study will perform on several samples weathering experiments that aim to identify the potential effects of time and weather on the composition and on the generated substances. The results are expected not earlier than December 2018.

2:What are the possible health or environmental aspects and technical/quality aspects and other differences of using alternative substances/mixtures as infill material? We are particularly interested in a comparison of the properties of PAH-containing and PAH-free granulates with regard to health and environmental hazards or risks, service durability, maintenance and replacement requirements, playability in different weather conditions, etc. Please specify all viable alternatives in your reply

ETRMA members are producers of tyres that, after their service life, are used to produce crumb rubber infill. The content of PAH in the oils used in the production of tyres is strictly regulated under entry 50 paragraph 1 of the REACH regulation. This measure guarantees safe conditions for the expected use of tyres for the human health and the environment.

End of life tyres (ELT) are the main source of raw material for recycled crumb rubber. It has proven to be a reliable material able to reply to the demanding technical requirements of infill of STF. Using ELT for infill of STF closes the recycling loop of tyres and helps Europe to meet its circular economy targets.

However some other materials that are suspected to be the source of impurities and high PAH content might be added in crumb rubber beyond ELT. Often this is neglected by researchers and has a tremendous impact on the final crumb rubber composition. Those non-suitable sources are for instance - rubber from other applications than tyres or post-consumer rubber scrap containing rubber from other applications than tyres.

ELT-derived crumb rubber – without non-suitable sources - has levels of PAH in the range of 20 ppm that do not pose a risk for the human health for all users of STF (players, workers, installers to name some). ECHA´s report *An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.* Version 1.01 of February 2017- concludes in page 57 ´ *that based on the available information, with the concentrations of polycyclic aromatic hydrocarbons (PAHs) found to be typically present in rubber crumb recycled from ELTs used as infill in synthetic sports fields), the concern for excess lifetime cancer risk for players and workers is very low.*´

We support a restriction to control the risk of high PAH in rubber infill that targets ***"rubber granulates used as infill material in synthetic turf sport"*** and sets thresholds that guarantee safe use conditions. The scope should cover not only ELT- derived rubber but any other recycled material used as infill material and virgin ones. Additionally a restriction will need **further regulatory measures** to successfully control risk, such as:

- Establishing of clear end of waste criteria at EU level

ELT Rubber granulates are currently considered as waste by a majority of Member States. If a restriction is introduced, its efficiency will be put into question as waste is outside of the scope of REACH. We strongly

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recommend that clearly defined end of waste criteria are introduced at EU level to ensure consistent interpretation of the scope of the restriction and guarantee legal certainty. The end of waste criteria should include chemical criteria reflecting the current regulatory requirements on the presence of chemicals and their concentration limits. ETRMA is willing to work with the institutions and contribute to the preparation of the end of waste criteria

Strong market surveillance across the EU

ECHA report acknowledges that some imported tyres entering the EU or other rubber material with unknown composition can be converted at the end of their life cycle into rubber granulates and may have different concentrations of substances than those produced from EU ELT. Indeed rubber granulates themselves may be imported, and the composition of such granulates is not known.

We would like to take the opportunity to remind that the efficient implementation of the restriction depends essentially on a clear definition of the scope and consistent interpretation, but also on strong market surveillance, which is critical for guaranteeing protection to consumers and level playing field for industry.

Introducing of international harmonized criteria for measuring of PAHs – as previously mentioned

Currently, there are no robust and internationally recognised sampling protocols and test methods that could allow article manufacturers to test their product and national authorities to ensure the necessary enforcement. We urge the EU institutions to treat the development of test methods as a high priority, as the efficiency of the measure and its coherent enforcement is at stake.

ETRMA is committed to work on the development of a test method to measure the level of PAHs contained in vulcanised rubber materials. We strongly support the ongoing work of JRC which aims at developing a method to measure the migration of PAHs from rubber products

3:As a manufacturer or an importer, please provide information on how many tonnes (metric tonnes) of plastic and rubber infill material (describe which infill material) you are producing or importing every year.

Globally, the infill demand for artificial turf is about 1,3 million tons, from which more than 90 % is estimated to be covered by SBR- which commonly refers to ELT-derived rubber.

A detailed overview of the main uses of ELT-derived rubber and the estimated percentage share by use of the overall market is available hereunder:

- Synthetic turf (30% of the overall market): ELT-derived rubber granulates are a valuable infill material that is used to provide proper resiliency and shock absorbance to the artificial turf playing fields.
- Sport Surfaces/athletic tracks and shock absorbing pavements (24% of the overall market): ELT-derived rubber can be used in many outdoor sport areas (primarily for athletics, multi-use sports,) to dissipate the vibrations and impacts that otherwise would affect the muscle-skeleton apparatus of the athletes. ELT-derived rubber is also used in indoor surfaces (for ex. volley, basket), generally with a PU top coating but this represents a small volume compared to outdoor surfaces.
- Moulded rubber goods (24% of the overall market): ELT rubber granulates and powders can be mixed with polyurethane binders to produce "re-moulded" rubber articles such as wheels for trolleys (e.g. caddies, dustbins wheelbarrows, etc), urban furniture, safety corners, rail filler block systems, etc.
- Other applications (22% of the overall market): Asphalt rubber, Equestrian floor, ...

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(more information is available on the comments already submitted to ECHA in the context of preparing the report *An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.* Version 1.01 of February 2017- and attached to this CoE for your convenience)

4:What are per unit prices and production costs of different infill materials? Can you provide an estimate of the substitution costs per pitch (including costs for labour, material, disposal of old material, transportation, etc.) when changing from an existing PAH-containing material to a different infill material? Are there any differences with respect to how frequent the whole infill material needs to be changed or replenished, i.e. are there different maintenance costs involved with the use of different infill materials?

N/A

5:What are the impacts (positive and negative) on your industry/organisation (manufacturer, distributor, importer, sports club/community owning the field) if a restriction on PAHs in granulates is imposed to lower the limit value to close to those set in the restriction entry 50 on PAHs in articles supplied to the general public? (see: substances restricted under reach)
Entry 5' P 5

We consider current PAH concentrations of ELT-derived rubber - in the range of up to 20 ppm - as the lowest feasible concentration for ELT-derived rubber. A lower content of PAH – as the one for rubber goods stated in the restriction entry 50 P 5 and 6 - will not be achievable using exclusively ELT as raw material and will compromise the current ELT recycling chain.

A lower threshold for ELT-derived rubber used as infill material in synthetic turf fields will *de-facto* exclude ELT-derived rubber from the infill market, currently the <u>first source of raw material for infill</u>, and unavoidably it will distort the current infill market for STF. It will also affect ELT-derived rubber producers, as infill for STF represents 30% of the overall market of ELT-derived rubber, and alike applications, such as sport or shock adsorbing pavements that might also be indirectly affected by the restriction, representing 24% of the share, altogether adding up to 54% of the overall ELT – derived rubber market.
(More information on ELT-derived rubber uses is available on the comments already submitted to ECHA in the context of preparing the report "An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.", Version 1.01 of February 2017- and attached to this CoE for your convenience).

ETRMA is conducting a Socio-Economic Impact Assessment to address the consequences of restriction scenarios, and to identify and quantify the consequences for ELT-derived rubber markets and society. The results are expected to be available by end of November 2017.

6:Please provide any information you may have on other substances (e.g metals such as cobalt and zinc, phthalates, benzothiazole and methyl isobutyl ketone) contained in plastic of rubber infill or in synthetic turf pitches (including substances used during the maintenance)) or other relevant information concerning possible risks to human health or the environment.

As previously discussed, in partnership with Fobig- a expert risk characterization consultant – ETRMA and CRIP (*Crumb Rubber Industry Platform)* launched the project *Assessment of exposure and potential risks to human health associated with the use of ELT recycled rubber crumb in synthetic turf fields (STF)* (informally called Fobig study) earlier this year. More than 50 samples of ELT – derived rubber will be collected, including samples of crumb rubber from recycling plants and directly from fields with ELT derived rubber as infill material, from outdoor and indoor facilities.

The study will look at the content of other substances suspected to be present in STF beyond PAH, namely metals (such as cobalt or zinc) or benzothiazoles.

We expect that the results will confirm current ETRMA knowledge on the presence and content of other substances in ELT-derived rubber, resumed hereunder. However, ***we would recommend to focus the restriction on PAHs, as for the time being, there is insufficient knowledge about the presence of other substances in crumb rubber and their concentration level.***

Possible presence of hazardous substances, estimated values in ELT-derived rubber granulates	CAS	Harmonised Classification under CLP regulation	estimation in ppm	
			min	max
DPG Diphenyl guanidine	102-06-7	acute tox 4, skin irrit 2; eye irrit 2 ; repro 2 ; STOT SE 3; aquatic chronic 2	0	150
6PPD N-1,3 dimethylbutyl N' phenyl-p-phenylendiamine	793-24-8		0	1000
Aniline	62-53-3	acute tox 3 H301 H311 H331 ; Eye Dam 1 ; skin sens 1; muta 2 ; carc 2 ; STOT RE 1 ; aquatic acute 1	0	100
MBT mercapto benzothiazole	149-30-4	Skin sens 1 ; aquatic acute 1 ; aquatic chronic 1	0	200
PTOP para ter octyl phenol	140-66-9	Skin irrit 2 ; Eye dam 1 ; aquatic acute 1 ; aquatic chronic 1	0	200
PTBP para ter butyl phenol	98-54-4	Skin irrit 2 ; Eye dam 1 ; repr 2	0	100

(more information is available on the comments already submitted to ECHA in the context of preparing the report *An evaluation of health risk of recycled rubber granulates used as infill in synthetic turf sport fields.* Version 1.01 of February 2017- and attached to this CoE for your convenience).

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Questions from ECHA - 21 June 2016
Industry contribution (15/7/2016)

Table of Contents

Introduction

Although ELT-derived rubber is the elastomeric material that is most commonly used worldwide as infill in sport fields, many other materials can be used as well. (see Table 1 and Figure 1 – Infill Value Chain description).

Table 1 Infill demand for artificial turf globally in 2009 & 2015 ('000 tonnes/year)

	SBR[1]	EPDM[2]	TPE[3]	Coated sand/SBR[4]	Other	Total
Contact sport[5]	550.5	3.5	17.3	2.0	3.5	**573.3**
Non-contact sport[6]	6.1	0.1	0.3	0.0	0.0	**6.5**
Leisure/DIY[7]	14.0	0.0	1.1	0.3	0.2	**15.4**
Landscaping[8]	4.1	0.0	0.0	0.0	0.0	**4.2**
Total	**574.7**	**3.5**	**18.7**	**3.7**	**3.7**	**599.3**

INFILL DEMAND FOR ARTIFICIAL TURF GLOBALLY IN 2015

	Penetration	Average Weight	SBR	EPDM	TPE	Coated sand/SBR	Other	Total
Units:	%	Kg/m²	'000 tonnes					
Contact sport	99.0	14.5	1,265.0	4.7	12.9	3.4	9.1	1,286.0
Non-contact sport	4.0	2.0	2.0	0.0	0.0	0.0	0.0	2.0
Leisure/DIY	2.0	5.0	3.6	0.0	0.0	0.1	0.2	3.7
Landscaping	1.0	5.0	0.8	0.0	0.0	0.0	0.0	0.8
Total			1,271.4	4.7	13.0	3.5	9.3	1,292.5

Source: AMI consulting – 2010 & 2016 Annual report on Artificial turf market

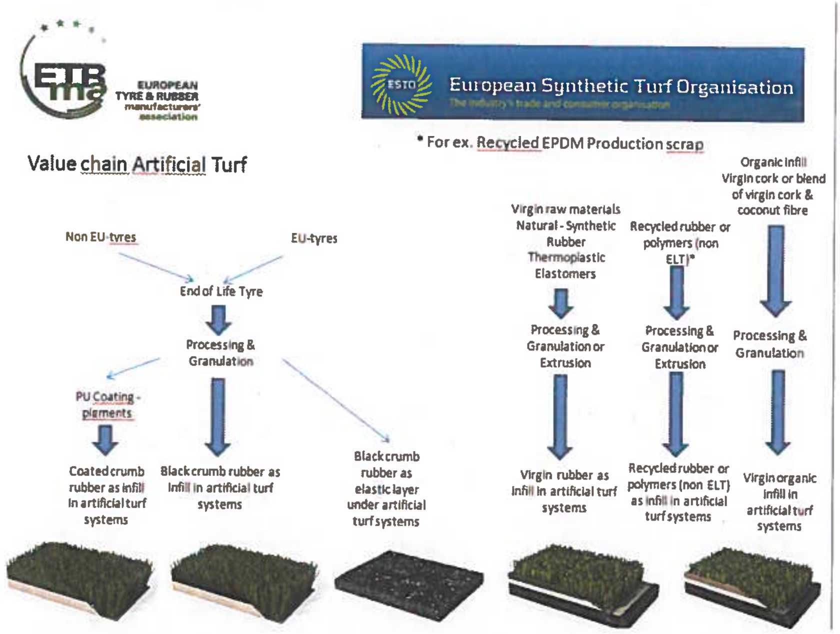
Besides the different types of infill materials (from virgin or recycled origin), several synthetic and/or natural materials are commonly used in artificial turf pitches and the presence of hazardous substances could derive from many sources that are not tyre rubber related.

[1] SBR: tyre recycled rubber is often referred to as SBR in the artificial turf market.
[2] EPDM: recycled polymers from industrial scraps or post consumper waste belong to this category.
[3] Thermoplastic Elastomers-TPE: often made of mixtures of virgin and recycled polymers.
[4] Coated SBR: crumb rubber coated with Polyurethane based coatings
[5] Contact sport: artificial infill.
[6] Non-contact sport: presumably elastic layers that are placed under the artificial grass carpets.
[7] Leisure: Artificial turf for playgrounds and similar applications.
[8] Landscaping: Artificial turf is often used in public areas in substitution to natural grass (more often in the USA than in EU) but it is not infilled with elastomers (only sand) because unnecessary.

Moreover, the possible use of infill materials other than "ELT-derived rubber granulate is often neglected by some researchers and the presence of unlikely amounts of pollutants (PAH and other) has been associated to tyre derived rubber although the origin of the analyzed samples was unknown.

Therefore, we recommend that the ECHA assessment of the risks potentially posed to human health should cover all types of "infill" for synthetic turf pitches and not only ELT rubber infill, even if ELT rubber infill is by far the most used solution.

Figure 1. Infill value chain description



N.B. ELTs are the major source for the production of tyre-derived granulates and powder. – Apart from ELTs, scrap from tyre production (e.g. tyres that after production are tested and fail to meet tyre product standards) and buffings from tyre retreading (mostly truck tyres) may also be used for the production of tyre-derived granulates and powder, but to a minor extent.

The following sources are not suitable for processing into ELT granulates and powder:
- Production scrap containing uncured rubber
- Production scrap containing rubber from other applications than tyres (for example, General Rubber Goods (GRG)).
- Post-consumer rubber scrap containing rubber from other applications than tyres (for example, General Rubber Good (GRG) products).

Q1 - What are the uses of recycled rubber granulates in the EU?

ELT derived rubber granulates and powders find new applications in many fields other than tyre manufacturing:

- **Synthetic turf**: ELT-derived rubber granulate is a valuable infill material that is used to provide proper resiliency and shock absorbance to the artificial turf playing fields.
- **Sport Surfaces/athletic tracks**: ELT-derived rubber can be used in many outdoor sport areas (primarily for athletics, multi-use sports,) to dissipate the vibrations and impacts that otherwise would affect the muscle-skeleton apparatus of the athletes. ELT-derived rubber is also used in indoor surfaces (for ex. volley, basket), generally with a PU top coating but this represents a small volume compared to outdoor surfaces.
- **Shock absorbing pavements**: ELT-derived rubber is typically used to produce shock-absorbing floorings (insitu or mats) that are durable in outdoor conditions, weather-resistant, permeable to water, etc.
- **Moulded rubber goods:** ELT rubber granulates and powders can be mixed with polyurethane binders to produce "re-moulded" rubber articles such as wheels for trolleys (e.g. caddies, dustbins wheelbarrows, etc), urban furniture, safety corners, rail filler block systems, etc.
- **Other applications: Asphalt rubber, Equestrian floor, ...**

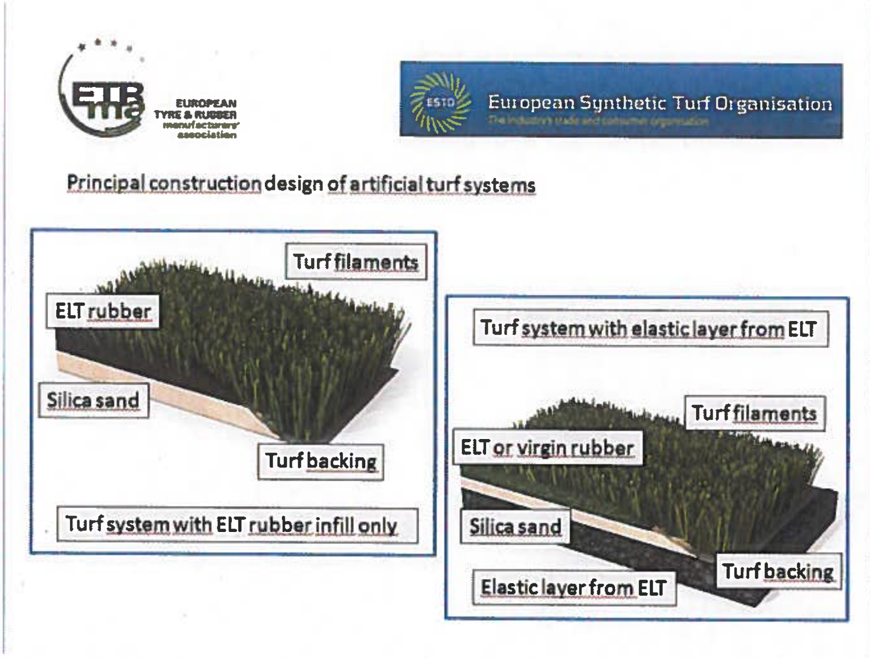
Synthetic turf

Combined Rugby and American Football field with artificial turf and rubber infill

Municipality football turf installation with artificial turf and rubber infill

See Aliapur video – "Synthetic turf": https://player.vimeo.com/video/114329341

Synthetic turf is composed of a mat of synthetic grass into which has generally been added a ballast bed of sand covered with a layer of loose granulates. The synthetic turf filaments of the turf form the grass blades and care for the "natural" look and feel. The rubber infill (mainly from ELT tyres) cares for softness, player protection, defined traction and rotational forces to mimic the natural turf feeling during usage.



Generally the systems are divided into two groups of system design. The first synthetic turf system with longer synthetic turf filaments (up to 60 mm) and a combined sand and rubber (ELT rubber) infill. These are still the most commonly installed artificial turf systems in Europe. The other group comes with an elastic layer from ELT rubber and Polyurethane resin (as in situ or mat) or other elastic sub-base systems and a turf with a shorter filament length. Also these systems are filled with sand and rubber from ELT or virgin origin.

The "New generation" synthetic turf surfaces now make it possible to get closer to the sensation of playing on real grass. The technique, with synthetic turf pile heights ranging from 35 to 65 mm (many systems being based on 60mm carpets) and a mixed ballast layer composed of sand and tyre granulate, has been approved by football's and rugby's highest authorities: FIFA,UEFA and World Rugby. World Cup qualification matches can now be played on these surfaces, on the condition that they satisfy very strict technical homologation criteria.[9]

[9] http://quality.fifa.com/globalassets/fqp-handbook-of-test-methods-2015.pdf
http://quality.fifa.com/globalassets/fqp-handbook-of-requirements-2015.pdf

It is possible to play on this type of pitch in practically all climatic conditions. Its use is almost unlimited, versus a limitation of 16h per week for natural turf. Synthetic turf requires no fertiliser, no mowing, no marking, no watering, and needs less maintenance than natural turf.

Certain municipalities install synthetic turf in order to reduce their water consumption and maintenance efforts. Others, on the contrary, use it to combat excessive rainfall, which makes natural turf unusable.

Synthetic turf has numerous advantages over natural turf: nothing is torn out during tackles in football or the scrum in rugby, rapid evacuation of water after bad weather, absence of frost on the pitch, and permanent ball bounce quality regardless of the climatic conditions.

The latest generation of synthetic turf makes it possible to reduce sport-based trauma. Both rugby and football players appreciate being able to train all through the winter on a pitch that has no mud, no bumps and no frost.

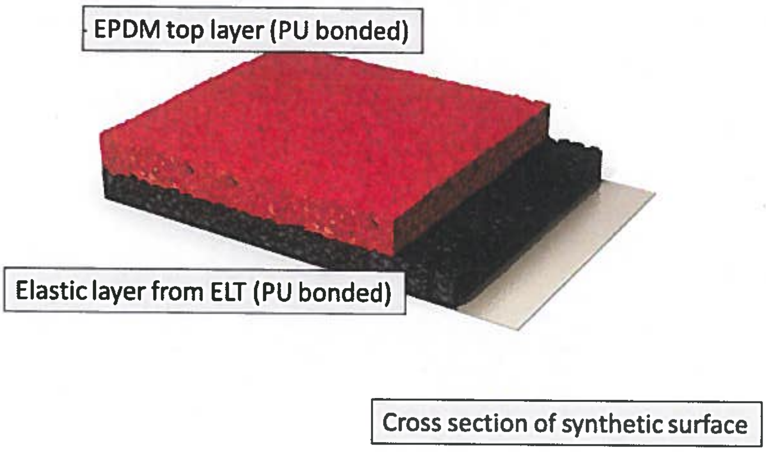
Athletic tracks, multi-sports facilities

All sports surfaces are characterised by the ability to guarantee an interface between the athletes and the support. Doing sports produces a series of shocks that have an effect on the body and can provoke injuries, fatigue or lesions. The aim of a modern sports surface is to delay, if not eliminate, all risk of trauma in the short, medium or long term for the athlete and user.

The sports surface industry, in correlation with current knowledge in the field of biomechanics, has introduced changes into the technical solutions it has proposed in the last forty years or so. In the last decade, sports federations (both national and international authorities) have initiated and lead these changes and have included in their regulations the results of the research published, mostly in the form of ISO & EN standards.

EPDM (Ethylene Propylene Diene Monomer) was very quickly and widely used in the form of granulate in the composition of sports surfaces in the 1970s until today, particularly as this type of track is coloured in the mass and the red colour (despite the fact that tracks are now made in blue or bicoloured) has become a sort of "reference" in the field. The association of two components (polyurethane resin and EPDM granulate) is commonly used as the top layer for the design of athletic tracks for a great number of manufacturers and suppliers.

Athletic track



Cross section of synthetic surface

ELT rubber granulate has been progressively introduced as it arrived on the market. It is used in the under layer and is covered either with EPDM granulate or projections of PU coating and EPDM powder. From this ELT rubber under layer the required sports performance, user safety properties and some additional properties like water permeability, evenness and sustainability are derived for the athletic tracks, the multi-purpose sports facilities and the fall protection areas in playgrounds and recreational applications.

Shock-absorbing surfaces

Rubber granulates can be used for manufacturing rubber tile surfaces, used in applications such as playgrounds, roofing and gallery tiles and stable tiles.

Shock-absorbing tiles produced from ELT rubber materials.

Rubber granulates can also be mixed with pigments and polyurethane binders then "poured in place" to prepare anti-shock surfaces, for example in playgrounds.

Poured-in-place rubber surfacing

The annual quantity of European rubber granulates that are destined to playground floorings is estimated at 200– 260 ktonnes. To improve the aesthetics of the surface, the top layer is made of pre-coated rubber or EPDM. Coated rubber is obtained by mixing rubber granulates with polyurethane binders and inorganic pigments. The outcome is granulate that has an inner core made of black ELT rubber and an outer layer made of polyurethane, mineral fillers and inorganic pigments.

Moulded rubber goods

1. Rail filler block systems

The rails used by tramways must be insulated from the base to prevent the propagation of static current, as well as to reduce noise and vibrations, making trams more acceptable in modern cities. To achieve this, ELT-derived rubber filler blocks, made from ELT granulates and a polyurethane binding agent, are used on both sides of the tramway rail leading to 3dB(A) noise attenuation or ELT-derived rubber sleepers are placed on both sides and below the rail with vibration attenuation performances up to -5dB(A).

ELT granulate can satisfy the complex specifications at a cost that is equal to, if not lower than, that of the fossil-based materials it replaces.

2. Acoustic screens

The use of ELT tyre in acoustic applications satisfies a dual need: the recycling of end-of-life tyres and the reduction in noise pollution.

The acoustic properties of ELT granulate have made it possible to develop a range of products from those that filter and absorb vibrations such as acoustic mats, to those that make use of properties such as acoustic screens, the aim being to optimise noise absorption by means of the screen.

3. Other Moulded objects

Once mixed with binders or resins, ELT granulates have many applications in moulded objects, particularly in the field of urban furniture. The objects can thus become speed bumps, bases for signs, and organisation accessories for cycle tracks, etc.

If granulate is ground even further, it becomes tyre powder. This powder is combined with a vulcanising agent, and then homogenized in mixers. The mixture is then poured into preformed presses and vulcanised in the form of long strips. This method is essentially used to manufacture the wheels on waste containers, as well as castors for scaffolding, wheelbarrows, hand trolleys or high pressure cleaners.

Uses as ELT rubber powder/granulate

Equestrian Floors

Equestrian floors are composed of a layer of ELT granulates bound with resin and covered with a layer of loose granulates. It combines the qualities of shock absorption, flexibility and elasticity, providing the horses with good impetus and limiting the impact of falls. Unlike the sand used in riding schools which gives off a lot of dust, the granulate floor does not require any watering, making it possible to make considerable savings in horse shoes.

Uses of ELTs in other applications

Noise barriers

Another application also consists in mixing the ELT rubber granulate with concrete to produce noise barriers that are typically found along motorways.

Asphalt rubber

Although car and tyre manufacturers have made considerable efforts to limit the noise pollution of vehicles, an additional decrease in road traffic noise can also come from new approaches in the construction of road surfaces.

ELT powder, once incorporated into bitumen or associated with coated products, makes it possible to improve the acoustic characteristics of the coated product, as well as its resistance to cracking caused by freezing and thawing. Similarly, it enhances the adherence of vehicles.

Tyres are used in the form of powder to manufacture coated road materials. The powder is incorporated into the mixture during the manufacture of the coated material. The aim of this application is to improve the acoustic characteristics of the coated material, as well as its resistance to cracking during freezing and thawing, and its adherence.

For a more exhaustive approach, Ecopneus, the main Italian ELT management company, has designed a product catalogue made of ELT rubber powder and granulates and categorised as follows:

http://www.ecopneus.it/it/catalogo-prodotti/elenco-prodotti/categorie/tp:Prodotto [only in Italian]

Field Code Changed

- Building (subflooring, antiskid, anti-trauma, anti-vibration, railway infrastructure, acoustic insulation, thermal insulation, road surface building, water-proof protection, wall coverings, ...)

- Sport: Anti-trauma sports, playgrounds, athletic track, basketball, football, multipurpose fields, hockey, gym, handball, volleyball, sports flooring, swimming pool, rugby, equestrian sports, tennis, ...

- Roads & urban furniture: Pedestrian areas, Street furniture, Modified asphalt, Pedestrian crossings, Curbs, Delimiters, Stop-rubber stakes bollards, Castors, pavements, Benches, Bike paths, Anti-shock-protection, Retarders, Roundabouts-beds, Signs

Q2 - What are the methods used in EU to manufacture the recycled rubber granules? Do you know if the methods are the same than in USA?

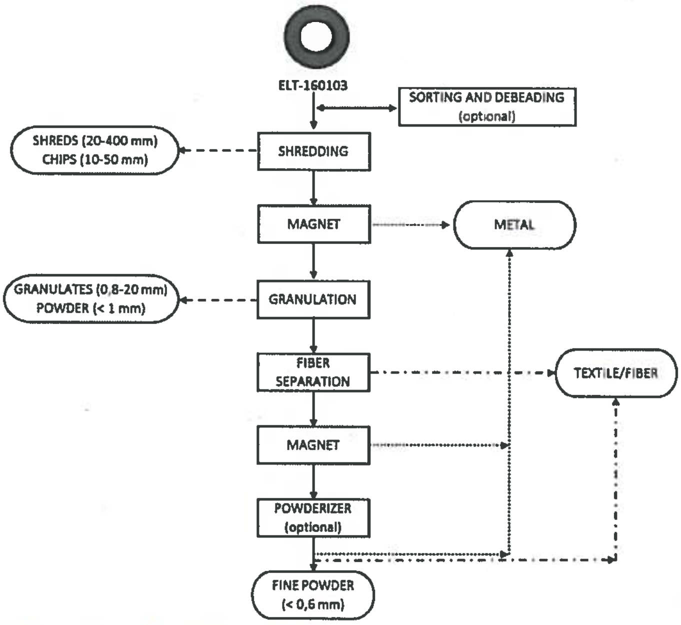
Technology of ELT treatment plants

End of Life Tyres (ELTs) may be shredded or ground at a number of grades, depending on the intended end use either through ambient or cryogenic grinding[10]

Ambient grinding

Rubber granulates and powders are produced from ELTs in a wide range of particle sizes and quality levels. Ambient grinding (as opposed to cryogenic grinding) is the production process used by the majority of ELT recovery plants operating in Europe. The process is called "ambient" because all size reduction steps take place at or near ambient temperatures, i.e., no cooling is applied to make the rubber brittle. It is a multi-step technology and ELTs are passed through a shredder that cut them to smaller pieces (shreds or chips). The chips are fed into one or more granulators that grind them into small pieces while removing steel and fibers in the process. Any remaining steel is removed magnetically and fibers through a combination of shaking screens and wind sifters. Finer rubber particles can be obtained through further grinding in secondary granulators and high-speed rotary mills. The below figure shows a typical ambient recycling process that can produce high quality rubber granulates and powders.

[10] UNEP Basel Convention – Technical guidelines for the environmentally sound management of used and waste pneumatic tyres



Typical Ambient grinding process (US & EU)

The output of a grinding plant is a series of granulates and powders that are sorted by particle size, typically smaller than 5 mm.

Cryogenic grinding

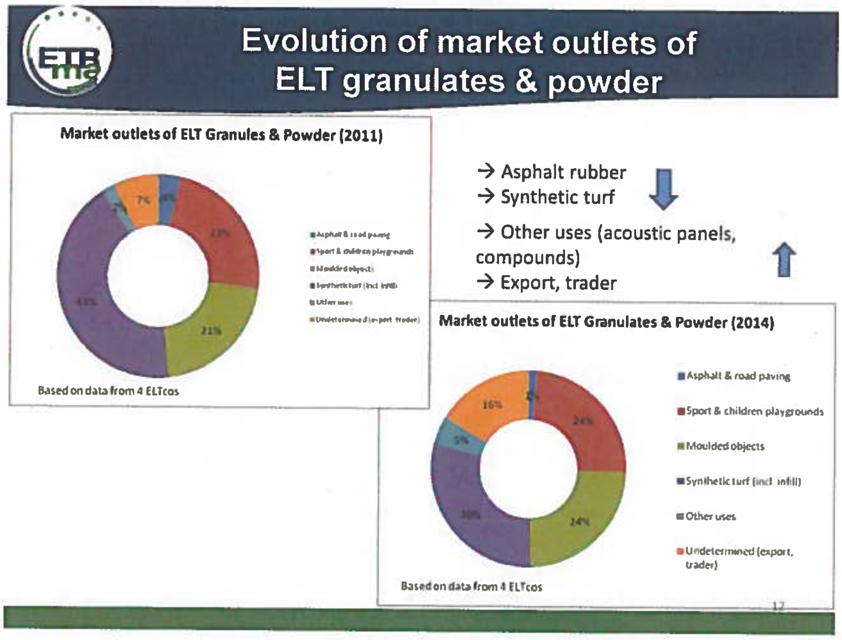
In cryogenic grinding, ELTs are first reduced to 50 mm chips by processing in a shredder. The chips are then frozen to temperature below -80°C in a freezing tunnel. The resulting rubber is brittle and glass-like, and therefore can be shattered into small pieces in the hammer mill. As with ambient processing, the metals and fibers are then removed from the particles. Because of the nature of crushing/shattering, the resulting particle size distribution is wider than with ambient grinding, and small particle sizes are achievable without additional processing.

The grinding/size reduction methods are globally the same in the US and in the EU. There is a higher % of cryogenic crumb rubber in US compared to the EU.
The composition of ELT granulates/powder is not altered neither by ELT ambient grinding nor by cryogenic grinding.

The same grinding technologies apply to other materials such as EPDM and TPE. TPE has additional specific processing steps (extrusion & cut).

Q3 - Tonnage of recycled rubber granules used in EU yearly for infill material – divided in synthetic turf used in sports fields, in recreation areas, in home gardens, others?

Based on consolidated data from 4 ELT Management companies11, here is an overview of the ELT granulates/powder market outlets at least representative for Portugal, France, Italy and Spain. Figures show that the share of synthetic turf (incl. infill) decreased from 43% in 2011 to 30% in 2014, that the use of ELT powder for asphalt rubber is a niche market and decreased whilst the use of ELT granulates for sport surfaces and children playgrounds is stable and the moulded objects segment is on the rise.

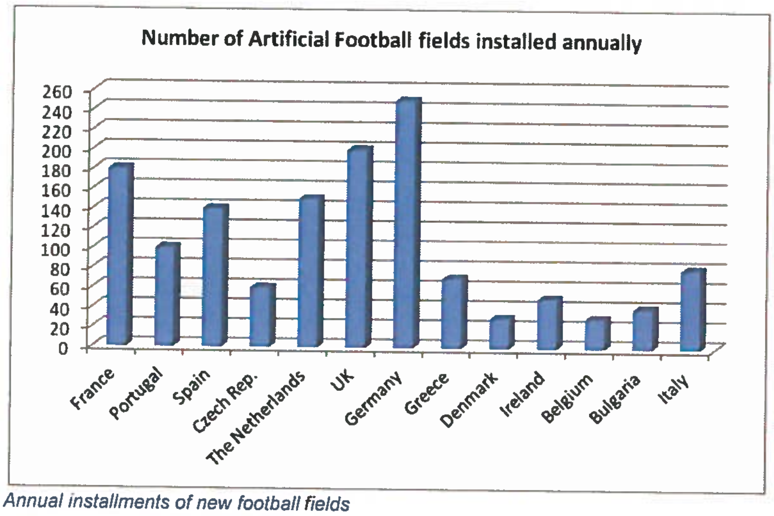


The use of recycled rubber on artificial turf fields

According to reports published by AMI Consulting, the global use of ELT rubber infill in synthetic turf worldwide increased from 550 to 1265 ktons/year.

Data from the major synthetic turf manufacturers operating in EU and ELT granulators indicate that ca. 1200-1400 of new football fields (incl. the replacement of old fields) are installed every year in Europe.

[11] Valorpneu (Portugal), Aliapur (France), Ecopneus (Italy) & Signus (Spain)



Annual installments of new football fields

More than 15.000 existing fields are currently in use throughout Europe.

Based on industry estimates, the quantity of ELT rubber infill that is used on European sport fields is about 80.000 to 130.000 tonnes/year.

Q4 - Tonnage used for new synthetic turf and tonnage used to replace the lost infill material in the old turf.

The quantity of rubber that is commonly used in a synthetic football field is around 110 tonnes that correspond to 15 kg/m² of granulates; a minor quantity of rubber per square meter is used on smaller fields (ca. 10 kg/m²).

On average 0.5 t to 1t of refill per year has to be supplemented per field; 3-5t per year in case of winter service. Other types of infill (with the exception of organic infill) have similar refill rates.

N.B. In terms of "material" used for replacement, synthetic turf installers recommend maintenance contractors using the same kind of infill as initially used but synthetic turf installers have no control on what maintenance contractors do.

Q5 - Average percentage of rubber granules originated from car tyres, from heavy vehicles (trucks etc.), from other articles e.g. conveyor belts

Based on ETRMA statistical data for the EU replacement market and estimation of the corresponding tonnage by ETRMA, the main sources of ELTs for collection and reuse/recovery are, in order of importance:

Tyre category	% in volume (number of units)	% (by weight)
Passenger car* tyres	91%	70%
Truck & bus tyres (Medium & Heavy truck)	4%	16%-20%
Tyres from motorbikes, scooters	4%	1%
Agricultural tyres	1%	6%-8%
Aircraft tyres**	N/A	< 0.5%
Civil engineering tyres	N/A	N/A
Industrial tyres (pneumatic)	N/A	N/A
Industrial tyres (massive tyres and banding)	N/A	N/A

* + trailers and caravan tyres, tyres from 4x4, SUV, Van & light commercial vehicles
** Aircraft tyres are normally retreaded several times. Those streams are generally not collected by ELT management companies.

Source: ETRMA

Therefore, most of ELTs sent to granulation are made of passenger car & truck & bus tyres. Depending on the available recycling operation/equipment, some ELT granulators are using only ELT truck tyres; others are using only passenger car tyres. It is nevertheless quite common that a mix of mainly car & truck tyres is being used for granulation. A major EU ELT granulator mentioned for example an average consumption of 80% passenger car tyres and 20% truck & bus tyres.

Q6 - Composition of rubber granulates (substances, average concentrations (especially CMRs Cat 1A and 1B) depending on the origin of the granules (car tyres/tyres from heavy vehicles/conveyor belts etc).

Answer under preparation

Q7 - Do you know if the composition of rubber granulates used as infill material in EU differs from the one used in USA?

Answer under preparation

Q8 - What happens to tyres in general in EU if they are not transformed to granulates (percentage to rubber granulates, other uses, waste etc)?

See Aliapur video “Le recyclage des pneus, comment ça marche” (Tyre recycling, how does it work) – sub-titled in English – for an introduction to tyre recycling.
https://vimeo.com/84843994

In 2013, about 3.59 million tonnes of used tyres were managed in an environmentally sound manner in EU. After sorting out the data of those tyres going for reuse (2nd hand tyres) or retreading, an estimated 2.88 million tonnes of end-of-life tyres (ELTs) were left to be treated.

This material flow went into a variety of recycling applications, public works and civil engineering or was used as a fuel substitute in cement kilns, boilers and power plants.

In numbers, this means that 1.32 million tonnes of ELTs went to material recovery and 1.42 million tonnes in energy recovery. Within material recovery, recycling of ELTs as tyre rubber granulate and powder into various applications is the main recovery route (1.12m tonnes), followed by the use of ELTs in civil engineering applications and public works (0.13m tonnes), as dock fenders, blasting mats (42.000t), in pyrolysis (23.000t) and as a reducing agent in steel mills and foundries (7.000t).

The below-mentioned table summarises how the 3.590.000 t of used tyres arising in EU28 (+NO+CH+TR) in 2013 have been managed in an environmental sound manner: 96% have of all used tyres arising have been reused, retreaded and recovered for recycling or energy, only 4% of the used tyres arisings are not traceable. Part-worn tyres still suitable for reuse or retreading represent about 20% of the Used Tyres arisings; 31% are sent to granulation for recycling, 4% used in civil engineering & public works applications, 2% are substituting coke in steel mills & foundries or used as dock fender and blasting mats or sent to pyrolysis, and nearly 40% is used for energy recovery (mostly in cement kilns).

Civil engineering, public works & backfilling	Granulation	Steel mills & foundries	Reuse for other purposes	Pyrolysis	Total Material Recycling	Material recovery	Cement kilns	Urban heating, power plants	Total Energy recovery	Retreading	2nd hand	Export	Total Reuse of Part worn tyres	Stocks	Landfill/Unknown
3,7%	31,2%	0,2%	1,2%	0,6%	33,2%	36,9%	33,6%	5,8%	39,5%	8,3%	3,5%	7,9%	19,7%		3,8%

Convert it in vertical form

Used Tyres recovery in Europe - *UT/Part Worn Tyres/ELT's Europe - Volumes Situation 2013*

National figures (tonnes)	Used Tyres (UT Arising)*	Reuse of Part worn tyres			ELT Arising	ELT recovery				Landfill/	Total UT treatment	UT treated
		Reuse	Export	Retreading		Material			Energy	Unknown		
	(A)	(B)	(C)	(D)	(E) = A (B+C+D)	Civil engineering, public works & backfilling (F)	Recycling** (G)	Total Material recovery (H) = (F+G)	Energy recovery (I)	(J)	(K) = (H+I)	(L) = K/A
Austria (est. 2010)	63.000	0	0	3.000	60.000	0	24.000	24.000	36.000	0	63.000	100%
Belgium	76.000	3.000	7.000	11.000	55.000	0	45.000	45.000	10.000	0	76.000	100%
Bulgaria (est.)	29.000	0	0	4.000	25.000	0	15.000	15.000	4.000	6.000	23.000	79%
Croatia	-	-	-	-	-	-	-	-	-	-	-	
Cyprus (est.)	5.000	0	0	0	5.000	0	0	0	0	5.000	0	0%
Czech Rep. (est.)	57.000	0	0	2.000	55.000	0	17.000	17.000	28.000	10.000	47.000	82%
Denmark	39.000	0	1.000	0	38.000	0	38.000	38.000	0	0	39.000	100%
Estonia (est.)	15.000	0	0		15.000	0	15.000	15.000	0	0	15.000	100%
Finland	51.000	0	0	1.000	50.000	34.000	8.000	42.000	8.000	0	51.000	100%
France (1)	457.000	20.000	50.000	35.000	352.000	33.000	92.000	125.000	227.000	0	457.000	100%
Germany	582.000	10.000	84.000	75.000	413.000	0	201.000	201.000	212.000	0	582.000	100%
Greece	34.000	0	1.000	1.000	32.000	1.000	15.000	16.000	14.000	2.000	32.000	94%
Hungary	36.000	0	0	0	36.000		27.000	27.000	9.000	0	36.000	100%
Ireland	30.000	3.000	1.000	1.000	25.000		12.000	12.000	9.000	4.000	26.000	87%
Italy (est.) (2)	421.000	22.000	17.000	28.000	354.000	2.000	118.000	120.000	234.000		421.000	100%
Latvia (est.)	9.000	0	0	0	9.000	0	4.000	4.000	5.000	0	9.000	100%
Lithuania (est.)	23.000	0	0	0	23.000	0	9.000	9.000	9.000	5.000	18.000	78%
Luxembourg	-	-	-	-	-	-	-	-	-	-	-	

Malta (est.)	1.000	0	1.000	0	0	0	0	0	0	0	1.000	100%
Netherlands	91.000	0	27.000	2.000	62.000	1.000	50.000	51.000	11.000	0	91.000	100%
Poland (est.)	169.000	8.000	0	3.000	158.000	0	35.000	35.000	123.000	0	169.000	100%
Portugal	84.000	5.000		13.000	66.000	1.000	38.000	39.000	27.000	0	84.000	100%
Romania	34.000	0	0	0	34.000	0	3.000	3.000	31.000	0	34.000	100%
Slovak Rep. (est.)	27.000	0	3.000	1.000	23.000	0	17.000	17.000	6.000	0	27.000	100%
Slovenia (est.)	15.000	0	0	0	15.000	0	8.000	8.000	7.000	0	15.000	100%
Spain	296.000	6.000	22.000	40.000	228.000	6.000	98.000	104.000	124.000	0	296.000	100%
Sweden	80.000	0	1.000	0	79.000	20.000	19.000	39.000	40.000	0	80.000	100%
UK (estimated by UTWG)	527.000	40.000	29.000	39.000	419.000	34.000	174.000	208.000	187.000	24.000	503.000	95%
EU28	3.251.000	117.000	244.000	259.000	2.631.000	132.000	1.082.000	1.214.000	1.361.000	56.000	3.195.000	98%
Norway (3)	39.000	0	1.000	0	38.000	2.000	11.000	13.000	18.000	0	39.000	100%
Switzerland (est. 2010)	40.000	0	40.000	0	0	0	0	0	0	0	40.000	100%
Turkey (4)	260.000	7.000	0	39.000	214.000	0	98.000	98.000	38.000	78.000	182.000	70%
EU28 + NO + CH + TR	3.590.000	124.000	285.000	298.000	2.883.000	134.000	1.191.000	1.325.000	1.417.000	134.000	3.456.000	96%

*(1) France: Since 2012 reported figures include the treatment of historical stocks by Recyvalor (12000t) in the treatments of ELTs and in the UT arisings. (2) Italy Reported figures include the treatment of historical stocks in the treatments of ELTs (in accordance with the legal prescriptions of the Italian ELT Decree) (3) Total UT recovery includes 7000t of stocks (4) In Turkey the 2013 national UT arising is estimated at 260000 t. The producer responsibility obligation for 2013 is limited to collecting and managing 70% of that tonnage. This obligation is set to rise to 100% by 2014. National obligations were fully met. *ETRMA UT arisings calculations methodology: New tyres (replacement market) + Retreaded tyres (national market) + import of second hand tyres. **Recycling includes ELTs sent to granulation (1119000t) use of ELTs in steel mills and foundries (x000t) as well as use as dock fenders, blasting mats... (13000t) and pyrolysis (23000t)*

Q9 - Does ETRMA have any further information on exposure to substances in ELT rubber granulates?

Answer under preparation

For further information, please contact:

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Glossary

Rubber Granulate: The result of processing rubber to reduce it to achieve finely dispersed particles, typically between 0.8 mm and 20 mm. *Source: CEN TS 14243*

Rubber Powder: The result of processing rubber and reducing it to achieve finely dispersed particles, typically under 0.8 mm. *Source: CEN TS 14243*

End-of-life tyre (ELT): A waste tyre no more suitable for its original purpose.

Shredding: Any mechanical process by which tyres are fragmented, ripped or torn into irregular pieces of 20–400 mm in any dimension. *Source: CEN TS 14243*

Ambient grinding: Mechanical size reduction at or above ordinary room temperature.

Cryogenic grinding: Size reduction at low temperature using liquid nitrogen or commercial refrigerants to make the rubber brittle. *Source: Basel Convention Technical Guidelines for the Environmentally Sound Management of Used Tyres*

Buffing: the removal of previous tread material (as part of the tyre retreading process), and the shaping, sizing and texturing of the casing surface to receive the new tread. Tyre buffings are derived from "buffing" the tyre.

Q6 - Composition of rubber granulates (substances, average concentrations (especially CMRs Cat 1A and 1B) depending on the origin of the granules (car tyres/tyres from heavy vehicles/conveyor belts etc).

All the information here below relate to rubber granulates derived from ELTs

General notions on tyre

Tyres are made up of various components, which include several parts, types of steel and rubber compounds. After curing ("vulcanisation"), the initially different rubber layers are part of single homogeneous compound. The main components in a tyre structure are shown in Figure 1 below:

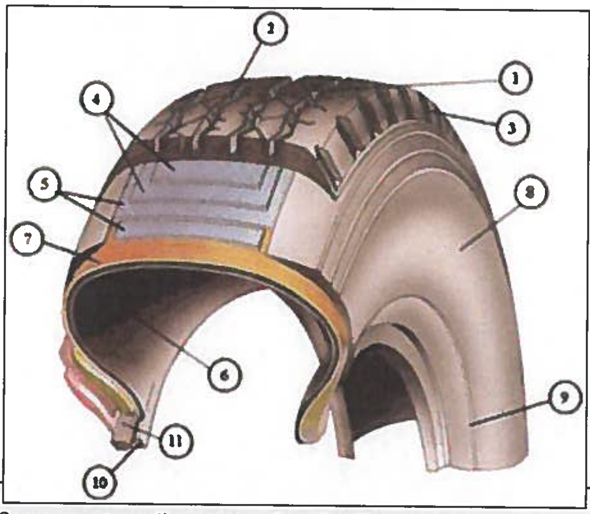

Figure 1: Components of a green tyre (i.e. not vulcanised)

"**Tread**" (1) the part of a pneumatic tyre that is designed to come into contact with the ground.
"**Tread groove**"(2) the space between the adjacent ribs or blocks in the tread pattern.
"**Sidewall**" (3) the part of a pneumatic tyre between the tread and the area designed to be covered by the rim flange.
"**Ply**" (4, 5) a layer of "rubber" coated parallel cords. In the radial tyre, it has the purpose of stabilizing the tyre.
"**Cord**" (6) the strands forming the fabric of the plies in the pneumatic tyre.
"**Casing**" (7) that structural part of a pneumatic-tyre other than the tread and outermost "rubber" of the sidewalls which, when inflated, supports the load.
"**Section width**" (8) the linear distance between the outside of the sidewalls of an inflated pneumatic-tyre, when fitted to the specified measuring rim, but excluding elevations due to labelling (marking), decoration or protective bands or ribs.
"**Belt**" (9) applies to a radial ply or bias belted tyre and is a layer or layers of material or materials underneath the tread, laid substantially in the direction of the centre line of the tread to restrict the casing in a circumferential direction.
"**Bead**" (10) the part of a pneumatic tyre that is of such shape and structure as to fit the rim and hold the tyre onto it.
"**Chafer**" (11) material in the bead area to protect the casing against chafing or abrasion by the wheel rim.

The above structure generically refers to passenger car tyres. Tyres intended for other vehicles (Truck and Bus, Motorcycle, Commercial van) may present differences in terms of reinforcing materials used in the carcass and/or compound composition.

Tyre typical composition

Table 1 - Main materials used in the formulation and production of tyres

Material	Application
Natural Rubber	Elastomeric part
Synthetic Rubber	Elastomeric part
Steel cord and bead wire including the coating materials and activators, brass/tin/zinc.	Steel is used to provide rigidity and strength to the tyres.
Reinforcing fabrics: polyester, rayon or nylon	Used for structural strength and of the carcasses of car tyres.
Carbon black, amorphous silica	Carbon black and amorphous silica provide durability and resistance against wear and tear.
Zinc oxide	Zinc oxide is added essentially as vulcanization activator. After vulcanization it is present as bound zinc in tyres.
Sulphur (including compounds)	Main actor of vulcanization.
Oils: MES (special purified, aromatic oil), naphthenic oil, TDAE (special purified aromatic oil), paraffinic oils	Oils are added to the rubber compound in the factory during the manufacturing process or added to purchased rubbers to improve the processability of the compounds. Additionally, the tread rubber compound achieves improved performance characteristics, mainly wet grip but also other characteristics like wear and endurance
Other additives and solvents: age resistors, processing aids, accelerators, vulcanizing agents, softeners and fillers	The other additives are used in the various rubber compounds to modify handling manufacturing and end-product properties.

Source: Adapted from "A National Approach to Waste Tyres", 2001 and ETRMA, 2001 and State of knowledge report for tyre materials and tyre wear particles , ChemRisk Inc, July 30, 2008.

Passenger car tyres and truck tyres represent the overwhelming majority of tyres sold on the EU market. The following table shows their respective average composition (pre-vulcanization).

Table 2 - Main components of new passenger car and truck tyres (average composition)

Material	Car	Trucks	Reacting during vulcanization ?
Rubber/Elastomers	43%	42%	YES
Carbon black & silica	28%	24%	YES
Metal	13%	25%	NO
Textile	5%	-	NO
Zinc oxide	2%	2%	YES
Sulphur	1%	1%	YES
Accelerators/antidegradants	2.5%	2.2%.	YES/NO
Stearic acid	1%	0.7%	YES
Oils	7%	1.6%	NO

Source: ETRMA

As reported in the above table, a substantial fraction of rubber chemicals do react during the vulcanization process, creating a three-dimensional network ("rubber matrix") in which those chemicals are bound.

Substances used in tyre manufacturing can generally be categorized in different groups:

- **Reactive substances**, which are involved in chemical reactions that transform these substances,
    - Substances that react during manufacturing process, by the creation of links with polymers and /or fillers
        - peptizers,
        - bonding agents,
        - vulcanization agents and accelerators,
        - cobalt salts
        - some types of tackifiers
    - Substances that react during the service life
        - Anti-oxidants, which react with ozone or ambient oxygen during the service life of the tyre and are present at the end-of-life in concentrations lower than the initial concentration
- **Unreactive substances**
    - plasticizers

Some of the previous listed chemicals are associated with transformation products as indicated below:

- Vulcanization agents (example: benzothiazole compounds, cyclohexylamine, di cyclohexylamine)
- Anti-aging agents and antidegradants (example: aniline, phenylenediamine compounds)

None of these latter substances are classified CMR Cat.1A or 1B

Composition of ELT-derived rubber granulates

Table 3 lists relevant hazardous substances which, according to expert judgement, might possibly be present in ELT-derived rubber granulates.

Table 3: substances possibly present, in ELT-derived rubber granulates (expert judgement)

Possible presence of hazardous substances, estimated values in ELT-derived rubber granulates	CAS	Harmonised Classification under CLP regulation	estimation in ppm	
			min	max
DPG Diphenyl guanidine	102-06-7	acute tox 4, skin irrit 2; eye irrit 2 ; repro 2 ; STOT SE 3; aquatic chronic 2	0	150
6PPD N-1,3 dimethylbutyl N' phenyl-p-phenylendiamine	793-24-8		0	1000
Aniline	62-53-3	acute tox 3 H301 H311 H331 ; Eye Dam 1 ; skin sens 1; muta 2 ; carc 2 ; STOT RE 1 ; aquatic acute 1	0	100
MBT mercapto benzothiazole	149-30-4	Skin sens 1 ; aquatic acute 1 ; aquatic chronic 1	0	200
PTOP para ter octyl phenol	140-66-9	Skin irrit 2 ; Eye dam 1 ; aquatic acute 1 ; aquatic chronic 1	0	200
PTBP para ter butyl phenol	98-54-4	Skin irrit 2 ; Eye dam 1 ; repr 2	0	100

VOCs that may potentially be emitted from ELT-derived rubber granulates, are listed below, but no measurement was done to provide any confirmation of it.

Table 4: VOCs potentially emitted by ELT-derived rubber granulates

	CAS	remark
Phenol	108-95-2	impurity
Formaldehyde	50-00-0	impurity
Ethanol	64-17-5	
Methanol	67-56-1	
MIBK methyl isobutyl ketone	108-10-1	
amines coming from sulfenamides	na	cyclohexylamine, dicyclohexylamine, terbutylamine
BT Benzothiazole	95-16-9	
Nitrosamines	na	on EU manufactured tyres : guaranty of the absence of volatile nitrosamines, and no guaranty in imported tyres

Elemental composition of ELT-derived rubber granulates

10.1.c ELT management company, has conducted extensive work on the chemical characterization of ELT rubber granulates.

The elemental analysis of ELT rubber granulates, reported in table 5, shows the presence of chemical elements not attributable to typical tyre recipes. Considering that tyres represent the interface of the vehicle with the road, it is reasonable to assume that some of these elements can come from road dust, asphalt, as well as breaking pad dust on the sidewall.

The data reported have been scientifically derived, based on a representative sampling of ELT shreds, for which the ELT-derived rubber fraction was analysed. This leads also to consider

ELT rubber granulates as homogeneous products.

In first approximation, those results are also applicable to ELT rubber powder.

Table 5: Elemental composition of ELT derived rubber fraction

	2015 batches of ELT shreds - Cat A tyres (Passenger Car) Rubber fraction				2015 batches of ELT shreds - Cat B tyres (Truck & Bus) Rubber fraction			
	μ	min	max		μ	min	max	
Carbon	**78.9**	78.1	79.6	%	**82.6**	82.2	83.3	%
Hydrogen	**7.2**	7.2	7.3	%	**7.6**	7.5	7.6	%
Nitrogen	**0.4**	0.4	0.4	%	**0.4**	0.4	0.4	%
Oxygen	**2.8**	2.6	2.9	%	**2.1**	2.0	2.4	%
Sulfur	**1.7**	1.6	1.8	%	**2.0**	1.9	2.2	%
Chlorine	**180.5**	155.0	212.0	mg/kg	**116.3**	99.0	151.0	mg/kg
Bromium	**309.6**	246.0	378.0	mg/kg	**754.8**	311.0	973.0	mg/kg
Fluorine	**<20**	<20	<20	mg/kg	**<20**	<20	<20	mg/kg
Silicon	**2.7**	2.4	3.0	%	**1.1**	0.6	1.8	%
Zinc	**1.5**	1.5	1.6	%	**1.9**	1.8	2.0	%
Iron	**989.2**	496.0	2310.0	mg/kg	**1286.3**	451.0	2239.0	mg/kg
Aluminium	**736.8**	626.0	876.0	mg/kg	**660.3**	603.0	797.0	mg/kg
Calcium	**3398.6**	2786.0	4144.0	mg/kg	**835.3**	545.0	1020.0	mg/kg
Potassium	**339.4**	305.0	371.0	mg/kg	**492.8**	396.0	656.0	mg/kg
Magnesium	**337.8**	288.0	394.0	mg/kg	**427.3**	359.0	507.0	mg/kg
Sodium	**476.4**	440.0	501.0	mg/kg	**290.8**	235.0	354.0	mg/kg
Phosphorus	**125.0**	118.0	136.0	mg/kg	**207.8**	184.0	233.0	mg/kg
Titanium	**56.4**	42.0	72.0	mg/kg	**42.8**	32.0	69.0	mg/kg
Arsenic	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Baryum	**7.2**	5.0	9.0	mg/kg	**9.3**	6.0	12.0	mg/kg
Beryllium	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Cadmium	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Cobalt	**111.0**	99.0	130.0	mg/kg	**201.8**	169.0	268.0	mg/kg
Chromium	**4.3**	3.0	7.0	mg/kg	**5.5**	3.0	12.0	mg/kg
Copper	**67.8**	47.0	86.0	mg/kg	**66.3**	39.0	111.0	mg/kg
Mercury	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Molybdenum	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Manganese	**7.4**	5.0	14.0	mg/kg	**9.5**	4.0	19.0	mg/kg
Nickel	**3.8**	3.0	6.0	mg/kg	**4.5**	3.0	8.0	mg/kg
Lead	**19.0**	15.0	21.0	mg/kg	**20.5**	11.0	25.0	mg/kg
Selenium	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Thallium	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg
Vanadium	**<3**	<3	<3	mg/kg	**<3**	<3	<3	mg/kg

Source: 10.1.c

Results show that carbon, hydrogen & oxygen represent 90% of the ELT rubber granulates mass. Adding the mass of zinc, sulphur & silicon provide 96% of the total mass of ELT rubber granulates.

Table 5bis: Elemental composition of ELT-derived rubber fraction by origin

	comments about the presence in ELT rubber granulates
C	Present
H	Present
N	Present
O	Present
S	Present
Cl	element coming from butyl polymer CIIR or residue from salts
Br	element coming from butyl polymer BIIR
F	not introduced in tyre
Si	Present
Zn	Present
Fe	Present
Al	Impurity in silica or it may come from kaolin used as anti-sticking agent
Ca	it may come from soaps used as anti-sticking agent and ubiquitous element
K	it may come from soaps used as anti-sticking agent and ubiquitous element
Mg	it may come from soaps used as anti-sticking agent and ubiquitous element
Na	Present, and ubiquitous element
P	it may come from soaps used as anti-sticking agent and ubiquitous element
Ti	not introduced in tyre, except as white pigment in white sidewalls
As	not introduced in tyre
Ba	not introduced in tyre
Be	not introduced in tyre
Cd	impurity that may comes from Zn
Co	Present : it comes from cobalt salts
Cr	not introduced in tyre ; few ppm could be present due to compound contact with stainless steel during tyre and/or crumb production
Cu	it comes from brass
Hg	not introduced in tyre
Mo	not introduced in tyre
Mn	not introduced in tyre
Ni	impurity in Co salt , or coming from stainless steel
Pb	impurity that may comes from Zn
Se	not introduced in tyre
Tl	not introduced in tyre
V	not introduced in tyre

PAHs

Table 6 – PAHs in ELT-derived rubber granulates

ppm		Mean	Min	Max
sum of 8 restricted PAHs	**Total**	**12**	**4**	**20**
	T&B	11	4	18
	Mix	12	4	20
	OLD	12	4	20
	NEW	11	4	19
	Unsorted	8	6	10

Source: Istituto Mario Negri, "Exposure to Recycled Tyre Rubber, Human Health & Safety", E. Davoli et al, 2016 (unpublished) and Characterization of rubber recycled from ELTs and assessment of the risks associated with dermal and inhalation exposure – Ecopneus 2015 (unpublished)

Legend:
T&B= 100% truck and bus tyres
Mix: from 8:92 to 70:30 mixes of T&B/PCT
PCT: Passenger Car tyres
Old= Production ante 2010
New= Production post 2010
Total: 25 samples
Unsorted= crumb rubber from 5 recycling facilities

Since the reference method for the determination of the PAH content in vulcanized rubber is an indirect test, two methods have been used to determine the PAH concentration in ELT rubber granulates:

- The Grimmer method (see Grimmer et al. (1997) Chemosphere 34, 2213-2226), based on an extraction in toluene followed by a column purification.
- A method developed by Istituto Mario Negri, based on a double extraction in Hexane/Dichloromethane (1:1).

Q7 - Do you know if the composition of rubber granulates used as infill material in EU differs from the one used in USA?

The composition of ELT-derived rubber granulates in the US and EU is very similar. Nevertheless, due to the fact that US does not have restrictions on the use of high aromatic oils, it is possible that slightly higher levels of PAHs may be present in US ELT-derived rubber granulates (e.g. due to imports sourced from Asian countries).
However all major tyre producers, despite the absence of local regulations in some countries (including the US), have eliminated the use of high aromatic oils all-over the world, applying entry 50 of Annex XVII of REACH regulation on a global level.