Committee for Risk Assessment (RAC)

Committee for Socio-economic Analysis (SEAC)

Opinion

on an Annex XV dossier proposing restrictions on

Polycyclic aromatic hydrocarbons (PAH) in clay targets for shooting

ECHA/RAC/RES-O-0000007147-73-01/F

ECHA/SEAC/[reference code to be added after the adoption of the SEAC opinion]

9 September 2022

OPINION ON AN ANNEX XV DOSSIER PROPOSING RESTRICTIONS ON POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN CLAY TARGETS FOR SHOOTING

13 September 2022

ECHA/RAC/RES-O-0000007147-73-01/F

9 September 2022

ECHA/SEAC/[reference code to be added after the adoption of the SEAC opinion]

Opinion of the Committee for Risk Assessment

and

Opinion of the Committee for Socio-economic Analysis

on an Annex XV dossier proposing restrictions of the manufacture, placing on the market or use of a substance within the EU

Having regard to Regulation (EC) No 1907/2006 of the European Parliament and of the Council 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (the REACH Regulation), and in particular the definition of a restriction in Article 3(31) and Title VIII thereof, the Committee for Risk Assessment (RAC) has adopted an opinion in accordance with Article 70 of the REACH Regulation and the Committee for Socio-economic Analysis (SEAC) has adopted an opinion in accordance with Article 71 of the REACH Regulation on the proposal for restriction of

Chemical name(s): **Polycyclic aromatic hydrocarbons (PAH)**

EC No.: **-**

CAS No.: **-**

This document presents the opinions adopted by RAC and SEAC and the Committee's justification for their opinions. The Background Document, as a supportive document to both RAC and SEAC opinions and their justification, gives the details of the Dossier Submitters proposal amended for further information obtained during the consultation and other relevant information resulting from the opinion making process.

PROCESS FOR ADOPTION OF THE OPINIONS

ECHA has submitted a proposal for a restriction together with the justification and background information documented in an Annex XV dossier. The Annex XV report conforming to the requirements of Annex XV of the REACH Regulation was made publicly available at https://echa.europa.eu/restrictions-under-consideration on **22 December 2021**. Interested parties were invited to submit comments and contributions by **22 June 2022**.

ADOPTION OF THE OPINION

ADOPTION OF THE OPINION OF RAC:

Rapporteur, appointed by RAC: Pietro PARIS

Co-rapporteur, appointed by RAC: Geneviève DEVILLER

OPINION ON AN ANNEX XV DOSSIER PROPOSING RESTRICTIONS ON POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN CLAY TARGETS FOR SHOOTING

The opinion of RAC as to whether the suggested restrictions are appropriate in reducing the risk to human health and/or the environment was adopted in accordance with Article 70 of the REACH Regulation on **13 September 2022**.

The opinion takes into account the comments of interested parties provided in accordance with Article 69(6) of the REACH Regulation.

The opinion of RAC was adopted **by consensus**.

ADOPTION OF THE OPINION OF SEAC

Rapporteur, appointed by SEAC: Klaus URBAN

Co-rapporteur, appointed by SEAC: Silke GABBERT

The draft opinion of SEAC

The draft opinion of SEAC on the proposed restriction and on its related socio-economic impact has been agreed in accordance with Article 71(1) of the REACH Regulation on **9 September 2022.**

The draft opinion takes into account the comments from the interested parties provided in accordance with Article 69(6)(a) of the REACH Regulation.

The draft opinion takes into account the socio-economic analysis, or information which can contribute to one, received from the interested parties provided in accordance with Article 69(6)(b) of the REACH Regulation

The draft opinion was published at https://echa.europa.eu/fi/restrictions-under-consideration/-/substance-rev/68411/term on **14 September 2022**. Interested parties were invited to submit comments on the draft opinion by **14 November 2022**.

The opinion of SEAC

The opinion of SEAC on the proposed restriction and on its related socio-economic impact was adopted in accordance with Article 71(1) and (2) of the REACH Regulation on **[date of adoption of the opinion]**. **[**The deadline for the opinion of SEAC was in accordance with Article 71(3) of the REACH Regulation extended by **[number of days]** by the ECHA decision **[number and date]]**[1].

[The opinion takes into account the comments of interested parties provided in accordance with Article[s 69(6) and][5] 71(1) of the REACH Regulation.**] [**No comments were received from interested parties during the consultation in accordance with Article[s 69(6) and][3] 71(1)**]**[6].

The opinion of SEAC was adopted **by [consensus**.**][a simple majority]** of all members having the right to vote. [The minority position[s], including their grounds, are made available in a separate document which has been published at the same time as the opinion**.]**[6].

[1] Delete the unnecessary part(s)

Contents

Tables

Figures

1. OPINION OF RAC AND SEAC

The restriction proposed by the Dossier Submitter is:

Table 1: Proposed restriction

Substances	Conditions of the restriction
Polycyclic aromatic hydrocarbons (PAHs) (a) Acenaphthene CAS No 83-32-9 EC No 201-469-6 (b) Acenaphthylene CAS No 208-96-8 EC No 205-917-1 (c) Anthracene CAS No 120-12-7 EC No 204-371-1 (d) Benzo[a]anthracene CAS No 56-55-3 EC No 56-55-3 (e) Benzo[a]pyrene CAS No 50-32-8 EC No 200-028-5 (Benzo[def]chrysene) (f) Benzo[b]fluoranthene CAS No 205-99-2 EC No 205-911-9 (Benzo[e]acephenanthrylene) (g) Benzo[e]pyrene CAS No 192-97-2 EC No 205-892-7 (h) Benzo[ghi]perylene CAS No 191-24-2 EC No 205-883-8 (i) Benzo[j]fluoranthene CAS No 205-82-3 EC No 205-910-3# (j) Benzo[k]fluoranthene CAS No 207-08-9 EC No 205-916-6 (k) Chrysene CAS No 218-01-9 EC No 205-923-4 (l) Dibenzo[a,h]anthracene CAS No 53-70-3 EC No 200-181-8 (m) Fluoranthene CAS No 206-44-0 EC No 205-912-4 (n) Fluorene CAS No 86-73-7 EC No 201-695-5 (o) Indeno[1,2,3cd]pyrene CAS No 193-39-5 EC No 205-893-2 (p) Naphthalene CAS No 91-20-3 EC No 202-049-5 (q) Phenanthrene CAS No 85-01-8 EC No 201-581-5 (r) Pyrene CAS No 129-00-0 EC No 204-927-3	From [date of entry into force of the restriction], clay targets shall not be placed on the market or used for shooting if they contain more than 10 000 mg/kg (1 % by weight of dry mass of the clay target) of the sum of all listed PAHs. From [date + 1 year from entry into force of the restriction], clay targets shall not be placed on the market or used for shooting if they contain more than 50 mg/kg (0.005 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

1.1. THE OPINION OF RAC

See RAC opinion

1.2. THE OPINION OF SEAC

SEAC has formulated its opinion on the proposed restriction based on an evaluation of the information related to socio-economic impacts documented in the Annex XV report and submitted by interested parties as well as other available information as recorded in the Background Document. SEAC considers that the proposed restriction on **polycyclic aromatic hydrocarbons (PAH)** is the most appropriate Union wide measure to address the identified risks, as concluded by RAC, taking into account the the proportionality of its socio-economic benefits to its socio-economic costs provided that the scope or conditions are modified, as proposed by RAC or SEAC, as demonstrated in the justification supporting this opinion.

The conditions of the restriction proposed by SEAC are:

Table 2: Restriction proposed by SEAC

The following 18 compound indicators shall be used: (a) Acenaphthene CAS No 83-32-9 EC No 201-469-6 (b) Acenaphthylene CAS No 208-96-8 EC No 205-917-1 (c) Anthracene CAS No 120-12-7 EC No 204-371-1 (d) Benzo[a]anthracene CAS No 56-55-3 EC No 56-55-3 (e) Benzo[a]pyrene CAS No 50-32-8 EC No 200-028-5 (Benzo[def]chrysene) (f) Benzo[b]fluoranthene CAS No 205-99-2 EC No 205-911-9 (Benzo[e]acephenanthrylene) (g) Benzo[e]pyrene CAS No 192-97-2 EC No 205-892-7 (h) Benzo[ghi]perylene CAS No 191-24-2 EC No 205-883-8 (i) Benzo[j]fluoranthene CAS No 205-82-3 EC No 205-910-3# (j) Benzo[k]fluoranthene CAS No 207-08-9 EC No 205-916-6 (k) Chrysene CAS No 218-01-9 EC No 205-923-4 (l) Dibenzo[a,h]anthracene CAS No 53-70-3 EC No 200-181-8 (m) Fluoranthene CAS No 206-44-0 EC No 205-912-4 (n) Fluorene CAS No 86-73-7 EC No 201-695-5 (o) Indeno[1,2,3cd]pyrene CAS No 193-39-5 EC No 205-893-2 (p) Naphthalene CAS No 91-20-3 EC No 202-049-5 (q) Phenanthrene CAS No 85-01-8 EC No 201-581-5 (r) Pyrene CAS No 129-00-0 EC No 204-927-3	From [*date of entry into force of the restriction*], clay targets shall not be placed on the market or used for shooting if they contain more than 50 mg/kg (0.005 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

2. SUMMARY OF PROPOSAL AND OPINION

2.1. Summary of proposal

The proposed restriction aims at preventing the release of polycyclic aromatic hydrocarbons (PAHs) to the environment from the use of clay targets for shooting.

Clay targets (also known as clay pigeons) are flying (saucer-shaped) targets used by sports shooters and small game hunters to practice. They are produced using binders such as coal tar pitch, high temperature (CTPHT), petroleum pitch or other types of resins.

CTPHT was included in Annex XIV of REACH (the Authorisation List) due to its carcinogenic, persistent, bioaccumulative and toxic (PBT), and very persistent and very bioaccumulative (vPvB) properties (Commission Regulation (EU) No 2017/999). These properties are due to the presence of PAHs. In 2019, ECHA received two applications for authorisation for the use of CTPHT as a binder in clay targets for sports shooting. The Committees for Risk Assessment (RAC) and for Socio-economic Analysis (SEAC) evaluated these applications and concluded that the continued use of CTPHT in clay targets would lead to a risk to human health and the environment through the release of several hundred tonnes of PAHs per year. On 16 March 2022, the Commission decided not to grant authorisation for the use of CTPHT as a binder in the manufacture of clay targets.

Several substances are used as alternative binders to CTPHT for clay targets in the EU. While these alternatives typically have lower concentrations of PAHs than CTPHT, many also contain PAHs. Alternatives with very low PAH-content and PAH-free alternatives are also available. In order to ensure a high protection of human health and the environment in the EU and avoid regrettable substitution, the Commission requested ECHA on 2 July 2021 to prepare an Annex XV restriction dossier on substances containing PAHs in clay targets for shooting complementary to, and incorporating, an Article 69(2) restriction proposal for CTPHT in clay targets.

ECHA (hereafter referred to as the Dossier Submitter) concluded that the use of PAH-containing binders in clay targets poses an EU-wide risk that is not adequately controlled. This applies equally to clay targets containing CTPHT and to those produced with alternative binders that also contain PAHs.

Based on the available information on alternatives and an analysis of the socio-economic impacts of a series of different restriction options underpinned by different concentration limits of PAHs in clay targets, the Dossier Submitter proposes to restrict the placing on the market and use in shooting of clay targets containing more than 0.005 % by weight of the sum of the concentrations of 18 indicator PAHs.

The proposed restriction is both effective in reducing the releases with a reduction of at least 99.3 % of the baseline releases, and cost-effective, with total costs of €3.6 million per year, a C/E -ratio of 13.5€/kg and marginal abatement cost of 130€/kg.

The proposed restriction option is practical and monitorable. The hazardous properties of the binders are due to the presence of PAHs. Because there are very many PAHs and their presence in the binders is variable, it is practical to base a limit on measurable and well-known PAHs that serve as indicators for the presence of other PAHs. Consequently, limiting the concentration of these 18 indicator PAHs in clay targets also limits the concentration of other PAHs in clay targets. To further support the practicality, the proposed restriction option is aligned with the rules of the International Sport Shooting Federation (ISSF), which impose a limit of 0.005 % w/w for the sum of 18 indicator PAHs in clay targets for their competitions. The Dossier Submitter considers that calibration standards and analytical methods are readily available for the targeted 18 PAHs. Clay targets can be bought from the markets and sampled.

2.2. Summary of opinion

SEAC has developed its opinion on the proposed restriction based on an evaluation of the information related to socio-economic impacts documented in the Annex XV report and submitted by interested parties, the opinion of RAC, Forum's advice on enforceability as well as other available information as recorded in the Background Document.

SEAC supports the view that any necessary action to address risks associated with "polycyclic aromatic hydrocarbons (PAH) in clay targets for shooting" should be implemented on an EU-wide basis, based on the key principles of ensuring a consistent level of protection of human health and the environment across the EU and of maintaining the free movement of goods within the union. SEAC agrees with the Dossier Submitter that the concerns raised equally apply to clay targets that contain PAHs imported into the EU.

The Dossier Submitter analysed four restriction options that are progressively stricter in terms of the permitted PAH-content in clay targets. Each of the restriction options sets a specific concentration limit value for 18-indicator PAHs. Apart from the specific concentration limit, all of the restriction options are identical in terms of their conditions. SEAC supports the approach of the Dossier Submitter for defining the restriction options. Furthermore, from SEAC's point of view, the use of indicator PAHs as proxies for all PAHs in clay targets is a practical and an analytically feasible approach for implementing the restriction.

The Dossier Submitter proposed to base the selection of indicator PAHs on the existing International Sport Shooting Federation (ISSF) guideline, i.e., to select the 18 indicator PAHs listed in their rules. SEAC supports the proposal to work with the ISSF's list of 18 PAHs, as this approach is already known to manufacturers and the sport shooting community, and therefore should support practicality and enforceability.

Due to the presence of PAHs with non-threshold hazardous properties in clay targets for shooting, the Dossier Submitter considered emission reduction as a proxy for both the risks and the benefits of the proposed restriction. SEAC agrees with this approach. The quantified costs include estimates of the loss of consumer surplus in terms of higher prices for consumers, and the additional administrative costs for society. Possible impacts on producer surplus, switching costs during the transitional period as well as impacts on the quality of clay target are considered qualitatively. SEAC agrees with the approach taken for estimating costs.

The Dossier Submitter used a cost-effectiveness approach to assess and compare the proportionality of the restriction options. SEAC notes that this is in line with SEAC's recommendations for impact assessments of restrictions and applications for authorisation that relate to PBT/vPvB substances. However, SEAC considers that impacts that happen during the transitional period should be included in the quantitative framework, to the extent that information is available.

The Dossier Submitter proposed RO3 as the preferred option. RO3 would set a PAH concentration limit value aligned with the rules of the ISSF, which impose a limit of 0.005 % w/w for the sum of 18 indicator PAHs in clay targets in their official competitions. The choice of RO3 is motivated by (i) the high effectiveness in terms of emission reduction (approx. reduction of 99% of emission in comparison to the baseline); (ii) sufficient availability of alternative binders; and (iii) the fact that many EU-based clay target producers are already producing clay targets that are in compliance with the proposed limit value. Moreover, the average C/E ratio of all ROs is at the lower end of C/E ratios of other, recent REACH Annex XV restriction dossiers. RO3 is considered by the Dossier Submitter to be the best option because it leads to a high emission reduction of 99% while avoiding some of the additional costs associated with RO4. RO4, which would practically impose a zero PAH-content of clay targets, was assessed by the Dossier Submitter to result in supply shortages, reduced quality of clay targets in some temperature conditions, and could possibly have an incremental cost of up to EUR 10 000 per kg of avoided emissions.

Furthermore, the Dossier Submitter proposed a transitional period of one year after the entry into force of the restriction. During this period, clay target producers would be allowed to use binder with a PAH concentration of up to 1% w/w. The Dossier Submitter deemed such a period necessary for avoiding a shortage of useable clay targets in the EU, by giving clay target manufacturers time to find new suppliers for low PAH content binders and to implement any adjustments to their manufacturing processes.

SEAC agrees with the Dossier Submitter that RO3 after a one-year transition period (i.e. banning CTPHT, petroleum pitch and petroleum resin as suggested by RO3) can be considered proportionate. SEAC notes that RO4 could also be considered proportionate. SEAC further remarks that C/E ratios of previous restrictions cannot serve as precise benchmarks to which C/E ratios of restriction options can be compared. Still, C/E ratios of previous restrictions addressing PBT/vPvB substances provide an indication of the order of magnitude of costs for the avoidance of emissions that have been considered tolerable to society. In the absence of empirical benchmarks for the restriction options evaluated in this dossier, SEAC highlights further arguments that are relevant for the choice of the restriction option. In particular, the incremental C/E ratio, expressing the additional costs required for avoiding the final two tonnes of annual emissions, is relatively higher between RO3 and RO4 (952 €/kg compared to 130 €/kg, assuming a 4% discount rate applied to costs and emissions). Furthermore, the short-term availability of binder available under RO4 (where only natural resin could be used) is more uncertain than under RO3. SEAC agrees that RO3 is the preferred RO.

SEAC concludes that a transition period prior to entry into effect of the RO3 concentration limit would be justified if the costs during this period can be assumed to be structurally different compared to costs after the transition period. This would be the case if clay target producers face substantial switching costs. SEAC has doubts whether the magnitude of switching costs that would be faced by clay target producers would be sufficient to justify a transition period, since the availability of suitable resins is not considered an obstacle for companies to comply with the proposed PAH-limit, and since most of the producers already have know-how how to produce clay targets that comply with the limit. For this reason, SEAC concludes that RO3 could be implemented immediately without the likelihood of resulting in disproportionate socio-economic impacts. Only in the case the sanctions against Russia reduce the availability of suitable binder materials and cause a shortage, and provided that these shortages cannot be compensated by other suppliers inside or outside the EU, SEAC concludes that a one-year transitional period would be justified to avoid disruption to supply chains. Under this scenario, a PAH concentration limit of 0.1% rather than 1% is preferred to remove clay targets produced using CTPHT and petroleum pitch from the market immediately.

The Dossier Submitter considered a number of uncertainties with a quantitative sensitivity analysis. These include uncertainties related to regulatory action, releases, quantities, prices, and methodological assumptions (i.e. price elasticity of demand, discounting). SEAC generally agrees with the categorisation of uncertainties, and with the list of uncertainties presented in Section 3 of the Dossier. In the case of discounting, SEAC added their own sensitivity analysis to the Background Document with a 0% discount rate for emissions. It was concluded that the choice of the preferred RO to be implemented remain unaffected by the use of a different discount rate.

SEAC concludes that the proposed restrictions would be practicable and monitorable.

3. JUSTIFICATION FOR THE OPINION OF RAC AND SEAC

3.1. IDENTIFIED HAZARD, EXPOSURE/EMISSIONS AND RISK

Justification for the opinion of RAC

3.1.1. Description of and justification for targeting of the information on hazard(s) and exposure/emissions) (scope)

Summary of proposal:

The proposal aims at restricting the presence of substances containing PAHs in clay targets. The Dossier Submitter proposes to restrict the placing on the market and use in shooting of clay targets containing more than a limit concentration of PAHs and has selected 18 PAHs to be used as indicators for the presence of PAHs in general in clay targets.

Four restriction options were analysed with different limits for the sum of the concentration of these 18 indicator PAHs in clay targets (1 %, 0.1 %, 0.005 % and 0.0001% by weight).

Based on this analysis, the Dossier Submitter proposes a ban of the placing on the market and use in shooting of clay targets containing more than 1 % by weight of the sum of the concentrations of 18 indicator PAHs applicable immediately from the entry into force of the restriction; one year from the entry into force of the restriction, the concentration limit value will be lowered from 1 % to 0.005 % (w/w) (50 mg/kg).

In practice, limiting the concentration of the indicator PAHs will prevent the use of certain binders which contain PAHs, to manufacture clay targets, as the concentration of PAHs in these binders is above the concentration limit suggested in the proposed restriction. Alternative binders that would meet the proposed concentration limit would not be restricted.

Because there are very many PAHs and the composition of the binders varies due to their variable and complex nature (unknown or variable composition, complex reaction products or of biological materials (UVCB)substances), it is practical to base a concentration limit on measurable and well-known PAHs that, at the same time, can serve as indicators for the presence of other PAHs. As a consequence, reducing the concentration of indicator PAHs also reduces the concentration of other PAHs in clay targets.

The Dossier Submitter considers that it is practical to align the restriction with existing voluntary rules in the sector. The rules of the International Sports Shooting Federation (ISSF) impose a limit of 0.005% (w/w) for the sum of 18 indicator PAHs in clay targets, for the Olympic Games, World Championships, World Cups, World Cup Finals and Junior World Cups.

Information on the hazards and concentrations of these 18 PAHs in clay targets is sufficient to underpin the need for a restriction.

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion:

See RAC opinion.

3.1.2. Description of the risk(s) addressed by the proposed restriction

3.1.3. Information on hazard(s)

Summary of proposal:

The hazard assessment of the binders used in clay targets is based on the properties of PAHs with known carcinogenic, PBT and vPvB properties, or which are identified as persistent organic pollutants (POPs). Although for pragmatic reasons a list of 18 indicator PAHs is the focus of the hazard assessment, other polycyclic aromatic compounds (PACs), such as larger PAHs, alkylated PACs and compounds containing heteroatoms, are also of concern. They are less studied and less frequently regulated but can display higher toxicity profiles (Andersson and Achten, 2015). A few alkylated PAHs and heterocyclic compounds have been quantified in the substances impacted by the restriction, but not consistently.

In summary, many of the PAHs in PAH-containing binders are genotoxic carcinogens. The data supporting these conclusions on carcinogenicity and genotoxic mode of action has already been extensively discussed elsewhere (e.g. RIVM, 2018, ECHA, 2019) and the conclusions have been formally recognised via harmonised classification[2] and identification as SVHC[3]. In addition, three PAHs (not among the 18 PAHs used as indicators) were recently included to Annex VI to CLP[4] for Carc. 1B and Muta. 2: benzo[*rst*]pentaphene (EC No. 205-877-5), also known as dibenzo[*a,i*]pyrene, dibenzo[*b,def*]chrysene (EC No. 205-878-0), also known as dibenzo[*a,h*]pyrene and dibenzo[*def,p*]chrysene (EC No. 205-886-4), also known as dibenzo[*a,l*]pyrene.

Additional PAHs may be genotoxic carcinogens even if they are not listed in Annex VI to the CLP Regulation. Furthermore, some of the binders themselves are classified as carcinogenic/mutagenic: CTPHT is considered to be a non-threshold carcinogen and has a harmonised classification as Carc. 1A and Muta. 1B; petroleum pitch and resin are classified as Carc. 1B and Muta. 1B in their registration dossiers; the substance EC No. 305-586-4 is classified as carcinogenic and mutagenic in its registration dossiers (the exact category depends on its constituents – the most severe classification in the registration dossier is Carc. 1A and Muta 1B); [Resin 3] (identifiers claimed confidential but known to the Committees) has a harmonised classification as Carc. 1B.

Nine PAHs have been identified as SVHC according to Articles 57(d) and/or 57(e) [5]. In the Support Document for identification of CTPHT as an SVHC (ECHA, 2009), the Member State Committee concluded that CTPHT is a substance containing at least 5 to 10 % of PAH-constituents with both vPvB and PBT properties and stressed that it should be considered that residual constituents of CTPHT may have a structure similar to the selected indicator PAHs with PBT or vPvB properties as well. Similarly, petroleum pitch consists at least of 1.9 % PAHs that are formally identified as vPvB and PBT (SVHC). Petroleum resin contains at least 0.2-

[2] Naphthalene (Carc. 2, H351), benz[*a*]anthracene (Carc. 1B, H350), chrysene (Muta. 2, H341; Carc. 1B, H350), benzo[*def*]chrysene (benzo[*a*]pyrene) (Muta. 1B, H340; Carc. 1B, H350), benzo[*e*]acephenanthrylene (benzo[*b*]fluoranthene) (Carc. 1B, H350), benzo[*e*]pyrene (Carc. 1B, H350), benzo[*j*]fluoranthene (Carc. 1B, H350), benzo[*k*]fluoranthene (Carc. 1B, H350), dibenz[*a,h*]anthracene (Carc. 1B, H350).

[3] Benz[*a*]anthracene (according to Article 57(a)), chrysene (according to Article 57(a)), benzo[*a*]pyrene (according to Article 57(a)(b)), benzo[*k*]fluoranthene (according to Article 57(a)).

[4] 14th ATP, in force from 9 September 2021, and 15th ATP, in force from 1 March 2022.

[5] Anthracene (PBT), phenanthrene (vPvB), fluoranthene (PBT, vPvB), pyrene (PBT, vPvB), benz[a]anthracene (PBT, vPvB), chrysene (PBT, vPvB), benzo[*def*]chrysene (benzo[*a*]pyrene) (PBT, vPvB), benzo[*k*]fluoranthene (PBT, vPvB) and benzo[*ghi*]perylene (PBT, vPvB). Due to a lack of data, it has only been concluded that benzo[*b*]fluoranthene fulfils the vP and T criteria, indeno[1,2,3-*cd*]pyrene fulfils the T criteria and dibenzo[*a,h*]anthracene fulfils the vB and T criteria.

0.3 % PAHs that are formally identified as vPvB and PBT (SVHC). In reality, the fraction of PAHs meeting the vPvB or PBT criteria may be much larger.

PAHs are subject to release reduction provisions under the POPs Regulation (Annex III, part B, of Regulation (EU) 2019/1021).

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion

3.1.4. Information on emissions and exposures

Summary of proposal:

The Dossier Submitter considered that 100% of the clay targets are released to the environment during their use. The Dossier Submitter initially explicitly indicated that releases are to the soil compartment; however, releases to the aquatic compartment may also happen (due to shooting over fresh or marine water, e.g., from a ship). However, the general consideration that 100% of the clay targets are released to the environment is unchanged and is therefore applicable to the environment as a whole, including soil and water. Once released, the clay target particles are a continuous source of PAHs until eventually virtually all constituents are transferred to other environmental compartments (which can lead to contamination of drinking water, plants, animals (thus food)), or are degraded. In addition, the following assumptions have been used by the Dossier Submitter to estimate the releases:

- 400 million clay targets per year are placed on the EU market in the baseline scenario;
- a clay target typically weighs 105 g and contains about 33 % of binder material.

The releases from the use of clay targets are therefore estimated as about 270 tonnes per year in the baseline scenario.

Table 3. Estimated release of PAHs during the use of clay targets (baseline scenario)

Binder	**18 PAH concentration in binder (%)**	**PAH concentration in clay targets (%)**	**Total, million clay targets**	**Total annual releases (t of PAHs) per target**	**Total annual releases (tonnes of PAHs)**
CTPHT	7.9	2.6	60	2.7×10^{-6}	164.2
Petroleum Pitch	2.4	0.79	116	8.3×10^{-7}	96.5
Petroleum Resin	0.2 – 0.3	0.07 – 0.10	122	6.9×10^{-8} - 1.0×10^{-7}	8.5 - 12.7
Eco Resin and Natural Resin (sum of 18 PAHs <0.005 % in clay targets) MAX based on limit	0.015	0.005	102	5.2×10^{-9}	0.5
Total			**400**		**269.7 - 273.9**

It has been estimated that the releases during the production of the clay targets is negligible,

although not null, compared to the releases during service life.

The exposure of workers and consumers has been assessed qualitatively in sections B.2.2.1 and B.2.3.1 in the Background Document.

The Dossier Submitter identified some uncertainties related to the estimation of releases, which are addressed in section 3.2: uncertainties on the identity of the binder materials and the alternatives (concentration of the 18 indicator PAHs and of the other polycyclic aromatic compounds potentially of concern), on the RMMs which may be used (e.g., collection of fragments and their disposal).

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.1.5. Characterisation of risk(s)

Summary of proposal:

The Dossier Submitter considered that the emissions of PAHs are a suitable proxy for the risks, following the approach agreed by RAC for assessing risks to the environment and to humans exposed via the environment for PBT and vPvB substances (ECHA 2020). The risks related to the carcinogenic properties of the PAHs to human health (workers and consumers) are considered qualitatively.

The Dossier Submitter estimated that about 270 tonnes per year of PAHs with PBT, vPvB and carcinogenic properties are released to the environment as a result of the use of PAH-containing binders in clay targets in the baseline scenario.

RAC conclusion(s):

- See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.1.6. Uncertainties in the risk characterisation

RAC conclusion(s):

See RAC opinion

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.1.7. Evidence that the risk management measures and operational conditions implemented and/or recommended by the manufactures and/or importers are not sufficient to control the risk

Summary of proposal:

No detailed assessment of implemented operational conditions and risk management

measures was presented in the Background Document. The Dossier Submitter based its proposal on RAC conclusions on the applications for authorisation submitted for this use, which are regarded as the most up-to-date and reliable source for information regarding risk management measures and operational conditions implemented and recommended by the manufactures and/or importers.

Two applications for authorisations have been received in 2019 for the use of CTPHT as a binder in clay targets for shooting. The applicants state that larger clay targets fragments are collected and assumed that the collected fragments are handed over to a professional waste company and treated as hazardous waste. In its assessment, RAC considered that "while the collection of larger fragments from some of the shooting grounds may provide some degree of reduction in the potential for release, this has clearly not been demonstrated to be effective in limiting the release of CTPHT to the environment". RAC concluded that the applicants have not demonstrated that risk management measures in place are appropriate and effective in limiting the risk for humans via environment and the environment. The Dossier Submitter further considered that collecting fragments would also lead to additional exposure of consumers. The nature and effectiveness of the waste treatment of the collected fraction is similarly unknown and may lead to releases of PAHs to the environment (e.g. from landfills).

The occupational exposure is not the main driver for the restriction proposal, and the exposure and risk characterisation for workers during the manufacturing of clay targets is considered qualitatively as supporting evidence to justify the need for a restriction and for the impact assessment. The Dossier Submitter notes that RAC also concluded that the operational conditions and risk management measures were not appropriate and effective in limiting the risk for workers producing the clay targets.

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.1.8. Evidence that the existing regulatory risk management instruments are not sufficient to control the risk

Summary of proposal:

Following an evaluation of the two applications for authorisation for the use of CTPHT as binder in clay targets for shooting, RAC and SEAC concluded that the continued use of CTPHT in clay targets would lead to a risk to human health and the environment through the release of several hundred tonnes of PAHs per year. The concerns raised equally apply to clay targets that contain CTPHT imported into the EU. In addition, RAC could not conclude whether the implementation of petroleum pitch instead of CTPHT would lead to an overall reduction in risk, but considering the intrinsic properties of petroleum pitch, RAC did not recommend the substitution of CTPHT with this alternative. The same considerations also apply to other binders containing PAHs at a level exceeding the concentration limit proposed by the Dossier Submitter.

PAHs are listed in Annex III, part B, of Regulation (EU) 2019/1021 on persistent organic pollutants (POPs). They are subject to release reduction provisions; Member States need to have inventories for PAHs released into air, water and land and programmes to reduce, minimise and eliminate releases (article 6 of the Regulation). However, the POP regulation aims to reduce, minimise and eliminate releases of PAHs in general (mainly to air) and it is not targeting specific uses such as the use of PAHs-containing binders in clay targets. For this reason, the Dossier Submitter concludes that the POP regulation is not sufficient to control the risk.

Although some national restrictions exist (in Austria, Belgium and the Netherlands) as described in section B.2.1. of the background document, they are not sufficient to control the risk at EU level.

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.2. JUSTIFICATION IF ACTION IS REQUIRED ON AN UNION WIDE BASIS

Justification for the opinion of SEAC and RAC

Summary of proposal:

The Dossier Submitter concluded that union-wide action is needed to address the risks associated with EU-manufactured or imported clay targets using PAH-containing substances as binder material. This will ensure that a harmonised high level of protection of the environment can be established across the Union, while maintaining the free movement of goods within the EU. The efficient functioning of the internal market for substances can only be achieved if requirements for substances do not differ significantly between Member States. Some EU countries, i.e. Austria, parts of Belgium (Flanders), and the Netherlands, have already restrictions in place on the use of CTPHT-based clay targets (see Annex XV report section B.2.1). On 16 March 2022, the Commission decided not to grant authorisation for the use of CTPHT as a binder in the manufacture of clay targets. One of the primary reasons to act on a Union-wide basis is the cross-boundary environmental pollution problem, caused by ongoing releases from the use of clay targets in all Member States except for Austria, Flanders (Belgium) and the Netherlands, which have already banned their use. Due to the PBT and vPvB properties of PAHs contained in CTPHT and other binder materials used in clay targets, the Dossier Submitter expects that environmental impacts may not be limited to the countries where the clay targets with PAH-containing binder materials are used.

Some of the PAHs[6] within the scope of the proposed restriction have been recognised[7] as POPs since 29/04/2004, which confirms their potential for persistence and long-range transport. The objective of the POPs Regulation is to prohibit, phase out as soon as possible, or restrict the manufacturing, placing on the market and use of POPs. Releases of POPs may contaminate remote areas that should be protected from further contamination by hazardous substances resulting from human activity.

Furthermore, the fact that clay targets produced with PAH-containing binder materials, imported as well as produced in EU, need to circulate freely once on the EU market and support the internal market of substances, stresses the importance of EU-wide action rather than action by individual Member States. In addition, the Dossier Submitter argues that EU-wide action would avoid the potential for distortion of competition on the European market between imported and domestically produced articles that could arise due to the authorisation

[6] These are: Benzo[b]fluoranthene (Benzo[e]acephenanthrylene), Benzo[k]fluoranthene, Benzo[a]pyrene (Benzo[def]chrysene), Indeno[1,2,3cd]pyrene

[7] PAHs are listed in Annex III, part B, of Regulation (EU) 2019/1021 on persistent organic pollutants (POPs). They are subject to release reduction provisions under the POPs Regulation, but they are not listed in the Stockholm Convention.

procedure.

SEAC and RAC conclusion(s):

Based on the key principles of ensuring a consistent level of protection across the Union and of maintaining the free movement of goods within the Union, SEAC and RAC support the view that any necessary action to address risks associated with "polycyclic aromatic hydrocarbons (PAH) in clay targets for shooting" should be implemented in all Member States.

SEAC and RAC agree with the Dossier Submitter that the concerns raised equally apply to clay targets that contain PAHs imported into the EU.

Key elements underpinning the SEAC and RAC conclusion(s):

Union-wide action to address the risks associated with EU-manufactured or imported clay targets using PAH-containing substances as a binder material is needed to ensure a harmonised high level of protection of the environment across the Union and to ensure the free movement of goods within the Union. In addition, the efficient functioning of the internal market for substances can be achieved only if requirements for substances do not differ significantly from Member State to Member State. Austria, parts of Belgium, and the Netherlands have already restrictions in place for the use of CTPHT based clay targets (see section B.2.1 of the Background Document).

SEAC and RAC generally support the union-wide approach for the following reasons:

- Releases of PAHs from the use of clay targets containing PAHs is a multi-local and cross-boundary environmental problem. Releases occur in all Member States except for Austria, Flanders (Belgium) and the Netherlands that have already banned the use of these types of clay targets.

- Due to the PBT and vPvB properties of PAHs contained in CTPHT and other binder materials, the human health impacts may not be limited to the countries where the clay targets with non-conforming PAH-containing binder materials are used.

- Due to the PBT and vPvB properties of PAHs contained in CTPHT and other binder materials, the environmental impacts may not be limited to the countries where the clay targets with PAH-containing binder materials are used.

- PAHs are recognised under the POPs Regulation since 29/04/2004, which confirms their potential for persistence and long-range transport.

- Furthermore, the fact that clay targets produced with PAH-containing binder materials, imported as well as produced in EU, need to circulate freely once on the EU market and support the internal market of substances, stresses the importance of EU-wide action rather than action by individual Member States.

- Only a restriction will prevent imports of clay targets that do not meet the PAH concentration limits proposed here. An EU-wide action would avoid the potential for distortion of competition on the European market between imported and domestically produced articles that could arise due to the authorisation procedure. European producers have already begun to substitute to more eco-friendly binder substances and have raised concerns over the imbalance of regulation between the imported and domestically produced clay targets.

- The method of restriction via a list of indicator PAHs and the indication of a sum limit value has proven successful in other restrictions according to REACH Annex XVII.

3.3. JUSTIFICATION THAT THE SUGGESTED RESTRICTION IS THE MOST APPROPRIATE EU WIDE MEASURE

Justification for the opinion of SEAC and RAC

Scope including derogations

Justification for the opinion of RAC

Summary of proposal:

As REACH authorisation does not cover placing on the market of the substance in articles, and the concerns raised equally apply to clay targets that contain CTPHT imported into the EU, these present an EU-wide risk and thus, based on REACH Article 69(2), ECHA needed to prepare an Annex XV restriction dossier. Several alternative substances to CTPHT are currently used as a binder for clay targets in the EU. While generally they have lower concentrations of PAHs than CTPHT, many of the alternatives also contain PAHs. Alternatives with very low PAH-content and PAH-free alternatives are also available. To ensure a high level of protection of human health and the environment in the EU, and to avoid regrettable substitution, the Commission requested ECHA on 2 July 2021 to prepare an Annex XV restriction dossier on substances containing PAHs in clay targets for shooting, incorporating the Article 69(2) dossier for CTPHT.

The Dossier Submitter has not included any derogations in its proposal. Instead, a phased entry into force is proposed with regard to the PAH content. The restriction would come into force in two phases:

Phase 1: From [*date of entry into force of the restriction*], clay targets shall not be placed on the market or used for shooting if they contain more than 10 000 mg/kg (1 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

Phase 2: From [*date + 1 year from entry into force of the restriction*], clay targets shall not be placed on the market or used for shooting if they contain more than 50 mg/kg (0.005 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

RAC conclusion(s):

See RAC opinion

Key elements underpinning the RAC conclusion(s):

See RAC opinion

Justification for the opinion of SEAC

Summary of proposal:

The Dossier Submitter has analysed four different restriction options that are progressively stricter in terms of the permitted PAH-content in clay targets. Each of the restriction options sets a specific concentration limit value for the 18-indicator PAHs. Apart from the specific concentration limit, all of the restriction options are identical in terms of their conditions. However, for the proposed restriction option, the Dossier Submitter proposes a two-phase approach.

Each of the options was assessed against its effectiveness in emission reduction and in terms of its economic cost. In terms of the other main criteria for a restriction, practicality and monitorability, the Dossier Submitter sees all restriction options as equivalent.

SEAC conclusion(s):

For the restriction of PAHs in clay targets, SEAC supports the proposed restriction options. They seem to be comprehensive and appropriate. Furthermore, from SEAC's point of view, the use of indicator PAHs as proxies for all PAHs in clay targets is a practical and also an analytically feasible method.

The Dossier Submitter proposes to base the selection of indicator PAHs on the existing ISSF guideline, i.e., to select the 18 PAHs listed there as proxies for all PAHs in clay targets. SEAC supports the proposal to work with a list of 18 PAHs by ISSF, as this approach is already known or followed by manufacturers and consumers and therefore should support enforceability.

SEAC supports the interim changes to the restriction conditions made by the Dossier Submitter that prohibit the placing on the market **and** use in shooting of clay targets to prevent the use of imported, non-compliant clay targets in the EU, clay targets from outside the EU or clay targets from stocks. SEAC would like to point out that in this case we are not dealing with an ordinary application of use. Until now, the term use implied the use above the EU continental shelf. There is evidence of i) clay targets being fired from shoreline and ii) clay targets being fired from ships. In both cases, targets are shot over maritime waters. SEAC considers this rare case in the remainder of this document.

SEAC generally considers a transition period to be unnecessary under the circumstances discussed in the restriction proposal. Manufacturers already had time to produce clay targets according to the rules introduced by ISSF. A large part of the clay targets produced in the EU are already "eco-friendly". Moreover, the proposed transition period is not cost-effective given SEAC's evaluation of the resulting costs and avoided releases during the assessment period. In light of the trade embargo on Russia, and if eco and natural resin falls under this embargo, a transition period of one year might, however, be justifiable. In this case, according to SEAC's analysis discussed later in this section and elaborated further in a SEAC Box in the Background Document in section 2.9., the use of petroleum resin during the transition period (and thus a ban of CTPHT and petroleum pitch) is considered more cost-effective compared to using petroleum pitch during the transitional period as proposed by the Dossier Submitter.

Key elements underpinning the SEAC conclusion(s):

The proposed restriction establishes a concentration limit for 18 indicator PAHs in clay targets. There are other PAHs (homocyclic, heterocyclic and alkylated) present in binders, which also may be of concern. Nevertheless, the Dossier Submitter assumes, similarly to the existing Entry 50 of Annex XVII of REACH, that restricting the amount of these 18 indicator PAHs in clay targets will also reduce the amount of other PAHs that could also be present in clay targets.

After a scientific review, the Dossier Submitter considers it practical to align the set of indicator PAHs and concentration limit with the rules of the ISSF. Indeed, the General Technical Rule 6.3.6 of ISSF[8] requires that "clay targets used in the Olympic Games, ISSF World Championships and World Cups, must be eco-friendly targets" and "clay targets used in Continental Games and Championships should be eco-friendly targets." To meet the definition of "eco-friendly" targets, the total concentration of the specified 18 PAHs has to be below < 50 mg/kg (i.e. 0.005 % w/w = 50 ppm). In addition, ISSF rules also specify that the targets need to comply with the following specific limits:

- < 1 mg/kg for benzo[a]anthracene, chrysene, benzo[a]pyrene, benzo[b]fluoranthene,

[8] Definition of eco-friendly targets available at: https://www.issf-sports.org/getfile.aspx?mod=docf&pane=1&inst=31&iist=29&file=ISSF_Rule_Interpretation_for_2017_ISSF_Rules_6.3.6_Definition_eco-friendly.pdf - accessed December 2021.

benzo[e]pyrene, benzo[j]fluoranthene, benzo[k]fluoranthene, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene, dibenzo[a,h]anthracene;

- < 10 mg/kg for naphthalene; and
- < 50 mg/kg for the total of seven PAHs (acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene).

The Dossier Submitter points out that the selected PAHs include the 12 indicator PAHs which were the basis of the Substance of Very High Concern (SVHC) identification of CTPHT (ECHA 2009). The selected PAHs also include the 16 PAHs identified by the U.S. Environmental Protection Agency (U.S. EPA) (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene), which have been the de facto standard for PAH-monitoring in the environment for decades. This ensures that analytical methods and knowledge in sample processing are readily available. In addition, benzo[e]pyrene and benzo[j]fluoranthene (which are not part of the 16 US EPA PAHs) are included in the scope of Entries 28 and 50 of REACH Annex XVII. They are also included in the scope of the restriction on granules and mulches used as infill materials[9]. Therefore, analytical methods are also readily available for these two substances. SEAC underlines that the subject of the restriction is the PAH content in the binder. However, as the binder content is considered fixed (33 %) and homogeneously distributed in clay targets, in the end the final products, i.e. clay targets with their integral content of PAHs, are subjected to the restriction. For this reason, the limit value on the sum of the indicator PAHs is also calculated on the mass of the clay target (% w/w).

SEAC notes that this set of 18 PAHs provides a clear legal basis for companies and enforcement authorities and is consistent with already existing rules in the sector. This is assumed to facilitate acceptability and implementability by producers of clay targets and enforceability of the restriction. Nevertheless, RAC noted that four of the proposed indicator PAHs do not have either a harmonised classification for CMR properties or are concluded to have PBT or vPvB properties[10].

Similarly, RAC discussed whether the non-inclusion of four non-classified, non PBT/vPvB PAHs including indeno[1,2,3-cd]pyrene, which is listed in the POPs regulation, or the inclusion of three recently classified PAHs[11] into the list of indicator PAHs would affect the effectiveness of the proposed restriction. RAC concluded that the Dossier Submitter's list of 18 PAHs was (i) sufficient to address the identified risk and (ii) that there was no evidence that an expanded list would improve the effectiveness of the proposal. SEAC sees no reason to deviate from the Dossier Submitter's proposal from a socio-economic perspective, as the proposal is intended to ban clay targets made with CTPHT, petroleum pitch and poor grades of petroleum resin (and any other binders containing PAHs at concentration exceeding the limit). The aim of restriction is not to ban specific PAHs.

SEAC agrees with the Forum's view that the addition of a dynamic link to the CLP Regulation (EC No. 1272/2008) and the REACH Regulation (EC No. 1907/2006) instead of a fixed list would impose an excessive administrative and enforcement burden on the restriction. SEAC

[9] https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e181d5746d

[10] acenaphthene CAS No 83-32-9, acenaphthylene CAS No 208-96-8, fluorene CAS No 86-73-7, indeno[1,2,3-cd]pyrene (CAS No 193-39-5, EC No 205-893-2)).

[11] Regarding ATP 14 and ATP 15, Carcinogenic category 1B: dibenzo[a,h]pyrene (CAS 189-64-0, EC No. 205-878-0), dibenzo[a,i]pyrene (CAS No 189-55-9, EC No. 205-877-5) (14th ATP, in force from 9 September 2021) and dibenzo[a,l]pyrene (CAS 191-30-0, EC No. 205-886-4) (15th ATP, in force from 22 March 2022).

considers the currently envisaged 18 indicator PAHs allow to ban some binders from the market and thus to minimise the release of other PAHs at the same time. Maintaining a fixed list also appears to improve predictability for industry and, thus, reduces uncertainty.

The Dossier Submitter considers the EU-wide use of about 400 million clay targets/year without distinguishing between use on land and water. However, there is information[12] available pointing out that clay targets are also launched over water and arrive in the water compartment either in pieces or as whole targets. Uses along the coastline or on board of sea- going vessels are known. SEAC requested information in advance of the six-month consultation on what quantities of clay targets are used over marine waters and whether this practice is also used over inland waters. SEAC did not receive quantitative information, but did receive a note (#3547) that clay target shooting also occurs over freshwater bodies, some of which are used for drinking water purposes.

From SEAC's point of view, differentiating the use of clay targets over water from uses elsewhere is relevant to consider as impacts (either to the aquatic environment or to humans from potentially via the food chain) may be more significant in comparison to uses over land. Furthermore, waste disposal from water is practically impossible.

As noted above, there is TV and video evidence of clay target shooting as an event on (cruise) ships. Consequently, non-EU flagged vessels with stocks of clay targets coming from international waters could enter EU territorial waters and use clay targets there. This is not an import but a prerequisite for the intended use. However, if the restriction is to be effective, the use of non-compliant clay targets would also have to be prohibited. SEAC therefore considers it necessary to ensure that the conditions of the restriction prohibit this use.. In this context, it should be noted that the Dossier Submitter has meanwhile agreed to an adjustment of the conditions and noted "... and use..." in the Background Document.

With respect to the expansion of the scope of the restriction to use, one additional question arises, which SEAC would like to evaluate here. The question concerns the fate of technical stocks of non-compliant clay targets at the date of entry into force and the implications for the appropriateness of the proposed restriction. With a restriction addressing the placing on the market of clay targets only, shooters at the end of the supply chain would still have the opportunity to make use of technical stocks of non-compliant clay targets. As a result, an unclear amount of additional PAH emissions would continue to occur for several years. With the above adjustment this possibility would be blocked. SEAC takes the view that even a combined ban on placing on the market and use in shooting would not necessarily lead to serious problems for the clay target market. According to the Dossier Submitter's research, there is at least one major manufacturer that claims to be able to serve the future "eco-friendly" clay targets market. Considering further that the market share of "eco-friendly" clay targets accounts for 30 % already, and that several clay target suppliers have expanded their portfolio by eco-resin based or PAH-free clay targets, it seems plausible to for SEAC to assume that also the remaining 70 % can be provided.[13] Furthermore, based on the analysis regarding cost-effectiveness and proportionality of restriction options presented later in this section and in a SEAC Box added to the Background Document, short-term shortages of binder, e.g. due to the magnitude of additional demand arising from the inability to use existing stocks, is not deemed to be have an impact on this conclusion. Last but not least, manufacturers can sell

[12] Clay target shooting from on board cruise ships has been featured in TV reports on the leisure activities on cruise ships while at sea. Clay target shooting from the coastline was confirmed by a report from a recreational diver. He found large quantities of clay targets shards on the seabed of European Mediterranean sea.

[13] Some clay target producers explicitly underline that they have expanded their portfolio in response to the ban of CTPHT-based targets in the EU, and in order to comply with ISSF standards.

residual stocks of non-compliant clay targets to customers outside the EU via duty-free warehouses. As such, the revised scope is deemed to be the most appropriate approach.

The Dossier Submitter has not included any derogations in its proposal. Instead, a phased entry into force is proposed regarding the PAH content. The restriction would come into force in two phases:

Phase 1: From [*date of entry into force of the restriction*], clay targets shall not be placed on the market or used for shooting if they contain more than 10 000 mg/kg (1 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

Phase 2: From [*date + 1 year from entry into force of the restriction*], clay targets shall not be placed on the market or used for shooting if they contain more than 50 mg/kg (0.005 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

This proposal would mean that coal tar pitch, high temperature (CTPHT) with a typical content of 7.9 % (and more) of PAHs would be banned immediately upon entry into force of the restriction. According to the Annex XV report, the transition from CTPHT to petroleum pitch is already expected. Suppliers are immediately able to comply with the 1% PAH concentration limit using petroleum pitch (containing 2.6 % of PAHs). The conditions of Phase 1 of the restriction are met for petroleum pitch (and other binders) because the PAH-containing binder is only used to about 33 % in the finished clay target, which means that the PAH content will be diluted by the filler material (ground limestone).

SEAC generally considers a transitional period to be unnecessary in the normal case, i.e. if sanctions do not have an impact on the availability of low PAH binders, for the following considerations:

1) ISSF already applies an internal standard for "eco-friendly" clay targets for Olympic Games and comparable international competitions, and parts of the supplier industry are thus prepared to supply clay targets meeting the conditions for continued use under Phase 2. ISSF (2021) also notes that clay target producers, in general, have had to often adapt to changing availability of raw materials for clay target production. As such, supply of compliant targets is not deemed to be a problem.

Further evidence supporting this conclusion is provided by the Dossier Submitter, according to which, a major EU supplier already supplies 30% of the market with "eco-friendly" clay targets. This supplier had also stated that it could cover the EU demand for "eco-friendly" clay targets by the start of the restriction. SEAC does, however, not have information regarding whether all suppliers of clay targets have been able to supply ISSF events with "eco-friendly" clay targets or at least are able to produce "eco-friendly" clay targets. As a result, it cannot be ruled out that some companies will be negatively affected. Impacts on a share of companies are however not deemed to be a sufficient justification for a transition period. This is especially the case as ISSF (2021) emphasized in its correspondence with the Dossier Submitter that most clay target producers already focus on either petroleum or eco resin-based targets.

This conclusion is further supported by a literature search conducted by SEAC as well as a check of the information provided by some of the clay target producing firms. SEAC could not find evidence that a switch to eco-friendly binders is leading, or is expected to lead, to market disruptions or a shortage of the supply of clay targets.[14]

2) The supplier industry will almost certainly manufacture targets based on a batch process,

[14] Cf. THE ECONOMY AND THE RISING COST OF CLAY TARGETS - Corsivia; Resin Natural – LAPORTE CLAY TARGET INDUSTRIES; Targets Vivaz - Ecological clay targets (platosvivaz.com).

i.e. a change in the quality of the end product by changing the input materials in connection with specific process parameters (see 3) seems to be possible with little effort and should not require much time.

3) Parts of the supplier industry have already had enough time to optimise the mixture of lime powder and alternative binders and the process parameters (e.g. mixing time, temperature in the mixer, temperature in the trace heating of tanks/pipes to the pressing tool and the heating of the pressing tool itself, pressing pressure and dwell time in the tool) to ensure the quality of the "eco-friendly" clay targets in practice. Thus, the transition process has already taken place or is ongoing.

4) Based on existing data, the information provided by ISSF (2021) and SEAC's assessment of the resulting costs and avoided releases during the assessment period, prohibiting only the use of CTPHT during the transition period (being equivalent to RO1) in combination with banning CTPHT, petroleum pitch and petroleum resin thereafter is not cost-effective because according to SEAC's analysis of the costs that would occur without a transition period, based on the information available, a higher emission reduction could be achieved at comparable costs when both CTPHT and petroleum pitch would be prohibited in year 1. This is further elaborated in Section 3.3.2.4.

During the consultation on the Annex XV report, SEAC received comments regarding the need for a transition period.

With respect to the time required for the substitution process, a company from Sweden (#3578) expresses doubts whether the transition can be completed within "1-2 years" because i) enough eco-friendly binders would not be available, and ii) smaller companies may not be able to implement the change so quickly. The author of the comment also doubts that a manufacturer of clay targets will invest in the production of new units if there is not enough raw material. Therefore, there may be a risk that some manufacturers of clay targets could disappear from the European market. According to the author of the comment, the supply of binders for clay targets was already limited before February 24, 2022, with much of it coming from Russia. Today, resin supply in Europe would be even more scarce due to the trade sanctions. Unfortunately, this argument was not further substantiated e.g. by providing market data about binder quantities and costs. Therefore, it is not possible for SEAC to quantitatively evaluate whether or not shortages in binders would occur, and how large expected shortages in the EU would be. Some qualitative considerations can however be provided by SEAC, and further substantiating data on this topic would be welcome during the consultation on the SEAC draft opinion.

According to the Dossier Submitter, 30% of clay targets made with eco resin and natural resin (PAH <50 mg in clay targets) consumed in the EU come from the United Kingdom and Russia. Although SEAC does not know the exact share of imports from Russia, it can be concluded that Russia[15] could be a strong supplier of eco resin and natural resin for PAH <50mg in clay targets and finished clay targets after the introduction of this restriction. As the United Kingdom and Russia both provide clay targets with eco resins and natural resins (with a concentration of PAH of less than 50mg) for the EU market, SEAC concludes that the United Kingdom and Russia are also potential suppliers of eco resins and natural resins as such. Russia could be an important supplier of natural resins from pine and fir and chemically modified rosin (gum rosin) based on its forest richness and open pit mining of amber in the Kaliningrad region.

Due to the war in Ukraine and the sanctions imposed as a result, Russia may no longer be able tosupply eco resin and natural resin and eco-friendly clay targets for an indefinite period of time. In connection with this political uncertainty, the supply chains for eco-friendly clay

targets in Europe have to be readjusted and a short-term shortage of binder raw materials, e.g. modified gum rosin, cannot be fully excluded. In light of the current sanctions and the associated uncertainty in the supply of binder raw materials for the production of eco-clay targets, SEAC considers that it would be justifiable to maintain a transition period of one year, while still considering that a transition period would not be required if the sanctions do not include the trade of eco resins and natural resins[16]. SEAC also notes that fall-outs of the supply of binder from Russia can potentially be substituted by higher imports from the UK. An alternative source could be crude tall oil (CTO) which is produced in the wood pulp industry in Scandinavia and Finland. After chemical modification, CTO could perhaps also fill a possible gap in modified natural resin as a binder. SEAC has no information on the quantity available.

Even if a transition period is granted, SEAC notes that the question of the RO to propose during this period remains. This point is further elaborated in Section 3.3.2.4.

If there is limited availability of PAH-free or PAH-low binders at the time this restriction enters into force, e.g. due to the sanctions on Russia or other supply chain disruptions, SEAC proposes the following condition for the restriction:

From [date of entry into force of the restriction], clay targets shall not be placed on the market or used for shooting if they contain more than 1000 mg/kg (0.1 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

From [date + 1 year from entry into force of the restriction], clay targets shall not be placed on the market or used for shooting if they contain more than 50 mg/kg (0.005 % by weight of dry mass of the clay target) of the sum of all listed PAHs.

Compared to the conditions of the restriction proposed by the Dossier Submitter, SEAC proposes a lower concentration limit during the transition period (i.e. 0.1 % instead of 1 %), which is equivalent to a ban of CTPHT *and* petroleum pitch in the first year, followed by a ban of petroleum resin thereafter. As discussed in this section further below, this option achieves a higher annual emission reduction at comparable cost.

3.3.1. Effectiveness in reducing the identified risks

Justification for the opinion of RAC

Summary of proposal:

The Dossier Submitter estimated that at least 270 tonnes of PAHs per year will be released to the environment from placing on the market of PAH-containing clay targets and their use in shooting under the baseline scenario (i.e. without any restriction). The Dossier Submitter has analysed four different restriction options that are progressively stricter in terms of the permitted PAH-content in clay targets. Each of the restriction options sets a specific concentration limit value for the 18-indicator PAHs. The effectiveness of the restriction options, expressed as tonnes of avoided releases per year once the transitional period is over, is presented in **Error! Reference source not found.** below. Under RO 3 (the proposed restriction), 99% of the releases would be avoided.

Table 4. Summary of the proposed restriction options

Restriction scenarios	18-PAH concentration limit (in clay target) w/w	Restricted substances (of those currently in the market)	Reduction in PAH releases compared to baseline	Remaining releases to the environment (tonnes of 18

[16] According to the information currently available, EU sanctions include the import of wood from Russia into the EU, but not the import of resins, see EU sanctions against Russia explained - Consilium (europa.eu).

			(tonnes of 18 indicator PAHs per year)	**indicator PAHs per year)**
RO1	1 %	CTPHT	114	156
RO2	0.1 %	CTPHT and Petroleum Pitch	247	23
RO3	0.005 %	CTPHT, Petroleum Pitch, Petroleum Resin, Other PAH-containing resin binders above the limit	268	2
RO4	0.0001 %	CTPHT, Petroleum Pitch, Petroleum Resin, other resin binders, eco resins	270	0

The Dossier Submitter notes that these figures (which take into account available information on the concentration of the 18 indicator PAHs in binders only) may underestimate the risks from the release of CTPHT and other binders to the environment if it is not capturing all PAHs in the binder matrix, as discussed in the assessment of uncertainties in section 3.2 of the Background Document. The releases of other PAHs (that are not part of the 18 indicators, but that may also be present in the binders) would also be reduced. This cannot be quantified based on available information. The estimates based on 18 indicator PAHs provide an indication on how the cost-effectiveness ratio is comparatively affected under each restriction option.

The Dossier Submitter has also assessed the impact of removing fragments from shooting grounds. Indeed, a fraction of the larger fragments of clay targets may be collected and disposed of, although the fraction of clay targets that is collected is unknown. Collecting fragments would also lead to additional exposure of consumers or professionals. The nature and effectiveness of the waste treatment of the collected fraction is similarly unknown and may lead to releases of PAHs to the environment (e.g., from landfills). For these reasons, the Dossier Submitter has not taken into account any removal of fragments in its proposal.

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

Add analysis that justifies the conclusion given above[12]

3.3.2. Socio-economic impact

Justification for the opinion of SEAC

3.3.2.1. Costs

Summary of proposal:

The costs of the restriction were estimated based on the expected welfare loss of consumers and producers, and on enforcement costs. Quantitative cost estimates of each restriction option consist of the expected welfare loss of consumers (i.e. the shooters) and of enforcement costs. The loss of consumer surplus results from an increase of the retail price for clay targets compared to targets which a higher PAH concentration which will be eliminated from the EU market due to the restriction. The assessment of costs for consumers is based

on the assumption that the demand for clay targets is fully inelastic. Hence, increased marginal costs for producers of clay targets due to higher retail prices of alternative binders will be fully passed on to consumers via a higher market price for clay targets. The Dossier Submitter assumes that this will not affect the annual number of clay targets consumed.

The assessment of costs is based on the fact that two authorisations are not granted for the use of CTPHT as a binder in clay targets for sports shooting. Consequently, EU production of CTPHT will cease and only imported CTPHT-based clay targets (60 million targets per year) will remain on the EU market. Producers of clay targets who can no longer use CTPHT as binder are assumed to switch to the least costly alternative binder material available.

Enforcement costs refer to the incremental costs to society to comply with requirements of a restriction that has come into effect. These costs are likely to be borne by two main groups of stakeholders: enforcement authorities and the industry placing clay targets on the market. Enforcement costs can be broken down in two main cost groups: administrative and analytical or testing costs. The former costs consist of incremental administrative costs for staff salaries, materials, equipment and overhead to be incurred to ensure compliance. Analytical testing costs include costs to develop testing methods and to test whether products meet the requirements of the restriction. Standard analytical methods exist to measure the 18-PAH concentration in clay targets (see Annex XV report **Error! Reference source not found.**).

ECHA (2017) estimates the incremental administrative costs for restrictions at approximately €55 000 per year using the fixed budget approach (i.e., enforcement authorities have a limited budget for enforcement, which they allocate to enforcing restrictions on the basis of the expected risk of non-compliance). The Dossier Submitter recognises the limitations of this approach. However, in the absence of other estimates, it is assumed that a restriction on the placing on the market as proposed would result in administrative enforcement costs of €55 000 per year, regardless of the RO.

For each restriction option, Table 5 summarizes quantitative total and incremental costs. Costs represent annualised values derived from a 20-year time path, assuming a discount rate of 4%.

The binders that can be used under the four ROs are characterised by subsequently lower PAH concentrations but increasing retail prices for the binder material used. While the price increase per clay target is zero when switching from CTPHT to petroleum pitch, it is 0.5 cent when switching from CTPHT/petroleum pitch to petroleum resin, 1.4 cent when moving to eco resin, and 1.9 cent when switching from eco resin to natural resin, respectively. The Dossier Submitter considers the additional cost for shooters when using eco resin to be moderate (35 Euros for an average shooter and 350 Euros for a competitive shooter per season). In relation to other costs of shooting, and considering a generally inelastic demand of shooters, the Dossier Submitter expects that the price increase of clay targets will not impact demand under RO3. Furthermore, considering the current market situation for binder, the Dossier Submitter assumes that producers can readily switch to alternative binders with a lower PAH concentration.

The highest price increase per clay target is expected when switching from CTPHT/petroleum resin to natural resin. Assuming the same consumption of clay targets consumed per season, this would lead to an additional cost of 47.5 Euros for an average shooter, and 475 Euros for a competitive shooter.

Table 5: Total and incremental annual costs of different restriction options

Restriction option	PAH concentration [%]	Total annual costs in comparison to baseline [Mio Euro/year]	Incremental change of costs [Mio Euro/year]

RO1	1%	0.0	0.1
RO2	0.1%	0.9	0.9
RO3	0.005%	3.6	2.7
RO4	0.0001%	5.5	2.0

Impacts to producers are, where relevant, discussed qualitatively. In particular, restriction options (ROs) 1 and 3 are, besides causing costs to consumers and enforcement costs, expected to cause impacts for the producers of clay targets. RO 1, which will ban the imports of clay targets containing CTPHT into the EU, is expected to lead to an increase of production within the EU, leading to a positive producer surplus effect. This implies that the total costs of RO1 will likely be lower. Under RO3, the Dossier Submitter considers it possible that the production of eco-friendly clay targets within the EU will be expanded. Similarly, RO4 can have positive or negative impacts on producer surplus due to the higher price for clay targets on the one hand, and a potentially decreasing demand for clay targets on the other. The size of these effects cannot be quantified due to lacking data, but were discussed in a qualitative way in the dossier.

Cost estimates presented in Table 5 represent annual costs occurring *after* the proposed transition period of 1 year. As illustrated in Table 5, total costs (i.e. the costs of a RO in relation to the baseline) are expected to be highest for RO4. In contrast, incremental costs (i.e. additional costs of a RO in relation to costs of the next cheaper RO) are highest for RO3.

SEAC conclusion(s) on the approach to assessing the costs of the restriction options:

Summary of conclusions:

SEAC supports the assessment of technical feasibility and comparison of the binder substances done by the Dossier Submitter.

SEAC agrees with the cost components distinguished in the restriction proposal, and the approach adopted by the Dossier Submitter for assessing costs to consumers. SEAC also considers it plausible that the estimated consumer surplus loss represents the maximum welfare loss to be expected under a certain restriction option. If clay target producing firms will not fully pass-on increases of input prices (i.e. the retail price for binder) to consumers (i.e. the shooters) the consumer surplus loss could be smaller. SEAC also notes that the price increase per clay target when switching from CTPHT/petroleum resin to natural resin is unlikely to impact the demand for clay targets. While supply shortages in case of a full and immediate switch to natural resin can induce an increase of the retail price for natural resin, SEAC considers it unlikely that this increase would lead to a significant decrease of the demand for clay targets.

Considering the current market situation for binder production as discussed in the restriction proposal, SEAC also considers it a reasonable approach to assume that binder producing firms can straightforwardly switch to alternative binder material, and that firms will usually choose the least costly alternative binder available. Given existing data and the qualitative information about the market for clay targets provided in the restriction proposal, SEAC considers the assumption of constant costs throughout the entire assessment period a possible, though rather uncertain scenario. Given the market situation for binder materials described in the restriction proposal, SEAC considers gradually decreasing retail prices for binder material to be more likely. Furthermore, a constant cost path seems only plausible if there is no transition period. SEAC notes that, if a transition period is adopted, additional costs that occur should be included into the cost assessment under either RO. In the absence of reliable data, the impact of price variations on the costs of ROs, and, ultimately proportionality of the ROs, the Dossier Submitter conducted a sensitivity analysis examining

the impact of price variations on costs. SEAC supports this approach. The implications of the sensitivity analysis on the cost path are discussed in Section 3.4.

SEAC considers a qualitative discussion of the possible impacts to producers of clay targets a reasonable approach, considering that under RO3 some imports of eco-friendly clay-targets can be expected. This can, at least to some extent, reduce or even outweigh possible gains of producer surplus resulting from an expansion of the manufacture of such clay targets within the EU. The Dossier Submitter furthermore expects that RO3 and RO4 might cause a potential loss of producer surplus due to a decrease of demand which, in turn, is expected to be the result of the higher retail price for resins used for eco-friendly targets. SEAC notes that this conclusion is not in line with the main assumption of price-inelastic demand adopted by the Dossier Submitter.

The Dossier Submitter assumes a lump sum incremental cost for administration and enforcement of the restriction of €55 000 per year. This is based on the fixed budget approach (i.e., enforcement authorities have a limited budget for enforcement, which they allocate to enforcing restrictions on the basis of the expected risk of non-compliance). In the absence of any other data SEAC considers this a justifiable approach.

If the proposed restriction applies to both the production *and* the use of clay targets, clay target producers may have to dispose of available technical stocks of binder with a PAH concentration exceeding the concentration limit. This is because demand for clay targets containing such binders might decline at an earlier point in time than without a restriction of the use of clay targets. In response to a restriction on use, consumers of clay targets, i.e. shooters, might stop purchasing such clay targets before the entry-into-force date based on the knowledge that they would not be able to use clay targets that they have in stock if those are non-compliant. Without a restriction on use, consumers might, in contrast, buy a higher amount of clay targets with higher PAH concentrations before the entry-into-force date to benefit from the lower prices and create stocks of such clay targets. In communication with SEAC Rapporteurs, the Dossier Submitter, however, expressed that these stocks are expected to likely be fully marketed by the time of the entry into force of the restriction. Thus, additional costs to producers for removing technical stocks are unlikely to occur, considering also that EU clay target producers can still market stockpiles of non-EU compliant clay targets through duty-free warehouses in countries outside the EU. In the absence of any other evidence SEAC considers this a plausible assumption.

Comment #3576 submitted to the consultation, furthermore, expresses concerns regarding the effect a restriction would have on the possibility of clay target producers to continue exporting clay targets manufactured with binder having a higher PAH content. SEAC considers these concerns to be unfounded The restriction does not refer to a ban on the production of clay targets manufactured within the EU with an intention for export outside the EU. SEAC agrees with the arguments provided by Dossier Submitter that the restriction would not preclude the manufacture and export of all types of clay targets with higher PAH-content. Given that no review period was granted for the use of CTPHT as a binder in clay targets, only clay targets with CTPHT-containing binder can no longer be manufactured in the EU, and exported outside the EU. Therefore, all binders, except CTPHT, whose use was not granted under REACH Authorisation, can thus be used for producing clay targets for export purposes. SEAC therefore notes that some producer surplus losses could be balanced off through exports to non-EU countries.

Key elements underpinning the SEAC conclusion(s) on the approach to assessing costs of restriction options:

The assessment of technical feasibility and comparison of the binder substances

SEAC supports the assessment of technical feasibility and comparison of the binder substances done by the Dossier Submitter. Basically, any binder material can be used as a glue for ground limestone if the final product, clay target, meets the following four criteria:

- **Strength:**
  Clay targets must be strong enough to withstand transportation, storage, loading in the launch machine as well as the high acceleration forces during thrown out.
- **Breakability:**
  Clay targets must be sufficiently brittle (or frangible) so that when they are hit by shots, the marksman can clearly tell by the explosive disintegration of the target that the hit has been registered.
- **Softening point:**
  The binder material needs to be able to withstand heat without softening and in wintertime deep temperature with sufficient impact strength, ductility. If the softening point is too low, the clay targets could be deformed or adhere together in the storage, rendering them unusable.
- **Processability:**
  The manufacturing process for clay targets consists of a hot moulding process in which milled limestone and binder are moulded together. The viscosity of alternative substances may affect their technical/economic feasibility if it is either too high (needs expensive higher process temperature) or too low cause seep from the moulds and lead to an inconsistent binder-to-filler ratio in the final product.

CTPHT is produced at the end of the value chain by vacuum distillation of coal tar and is almost a waste product, but meets the above four criteria, so is considered by industry to be perfect as a cheap binder material. With its use as a binder in clay targets, the industry found a niche to market it without having to bear the cost of disposing of it as hazardous waste. In this respect, the price increase shown by the Dossier Submitter for alternatives with less or no PAH content is reasonable. A first alternative binder is **petroleum pitch**. It was claimed by industry that the clay targets made with it were not equivalent in quality to clay targets made with CTPHT. The Dossier Submitter concluded that this claim was not substantiated by comparing performance with the four established criteria. As the PAH content in clay targets when using petroleum pitch as an alternative is similar to that of CTPHT - 2.6% to 0.8% - it is therefore proposed that the use of petroleum pitch should also be restricted.

Regarding **petroleum resin** as a second possible alternative binder for clay targets, the applicants for authorisation did not consider it as a short-listed alternative and did not provide any analysis of its technical properties. Clay targets produced with petroleum resin are widely available, and based on industry sources (ISSF, 2020), there is no difference to be reported between the quality of such targets and those produced with CTPHT as a binder. However, use of ordinary petroleum resin as a binder would still result in about 0.07 % PAHs in clay targets. Therefore, this alternative does not meet the industry specification for eco resin (< 0.005 % PAHs).

The third alternative is the group of **eco-resin**-based clay targets. Unfortunately, there is no scientific analysis of the technical performance of these targets against the four criteria. However, according to the Annex XV report, there is clear evidence that the technical feasibility of such targets is comparable to that of targets made from CTPHT. This information has been confirmed by several industry sources (ISSF, 2020), shooters' representatives (Finnish Shooting Association, 2021) and a major manufacturer of targets using eco-resin as a binder (Eurotarget, 2020). It should be noted that eco-resin-based clay targets also meet the ISSF requirements for environmentally friendly clay targets (when the total 18 indicator PAHs < 0.005 %). According to the Annex XV report, the clay target market has already partly switched to eco-resin-based targets, with many manufacturers marketing/producing only these, and many shooting clubs have already switched to shooting only eco-friendly targets (FSSF, 2021).

With regard to the category of **natural resins** (content of PAHs close to zero or zero), of which pine resins (rosin) are the most common example, the Dossier Submitter quotes from authorisation applications for the use of CTPHT as a binder in the manufacture of clay targets that the use of this group of resins may cause problems in manufacturing and coating. It is also indicated that clay targets made with such resins may be more brittle and more likely to

develop cracks than those made with CTPHT. However, the Dossier Submitter did not find any such indications in any of the interviews and cannot confirm these technical problems in connection with the use of natural resins. Clay targets made with natural resin may soften at more than 30 to 40 degrees Celsius which, however, should be technically solvable, at the latest by replacement with eco resins.

The European market for binder material

In the EU, the switch from CTPHT as binder material to other binders with a lower PAH content is already ongoing. Therefore, typical barriers that could hamper a switch to the production of clay targets using alternative binder such as, for example, economic constraints (including the need for major additional capital investments, upscaling of a new, unproven technology), or constraints due to lacking knowledge infrastructure[17], do not seem to exist. Petroleum pitch is assumed to be widely available in the EU (with an annual tonnage volume of 10 000 – 100 000 tonnes). The largest producers in the EU already produce the vast majority of their targets using either petroleum resin, eco resin or natural resin as binder materials. Moreover, according to the Dossier Submitter the availability of alternative binders which would meet the more stringent PAH concentration of 0.005% (eco resin and natural resin) does not seem to be a critical issue within the EU. There is anecdotal evidence that pine rosin, used in the natural resin-based clay targets, may not be as easily available for the clay target manufacturers. As a consequence, if all clay targets have to be produced with natural resin alone as a binder (under RO4), short-term scarcity in clay targets might occur. With respect to RO4, the Dossier Submitter can, in fact, not conclude whether the required tonnage for the production of clay targets (approximately 13 000 tonnes annually) complying with requirement of a low PAH content will be available. In this case, a short-term scarcity of clay targets could occur. With respect to eco-resin based targets, one of the largest producers of clay targets in the EU declared to be able to fully satisfy increases in demand for eco resin-based targets. SEAC therefore considers it plausible that sufficient alternative binder with a PAH concentration of less than 0.005% (RO3) would be available to meet the demand for clay target production in the EU under RO3 under the market circumstances described in the restriction proposal. Furthermore, SEAC considers it realistic that producers of clay targets are able to switch to low-PAH or PAH-free binder material in the medium term given that largest producers in the EU already produce the vast majority of their targets using either eco resin or natural resin as binder materials.

During the consultation, however, two comments were provided (#3578 and a further confidential comment) suggesting that scarcity of eco-resins and natural resins could lead to supply problems on the European market for clay targets. Comment #3578 provides reference to the impact of the trade sanctions on Russia on the supply of clay targets based on eco-friendly binder material (see also Section 3.3). In conjunction with the trade sanctions on Russia, SEAC thus considers it possible that the gap in the availability of eco resins and natural resins could widen. The implications of this uncertainty will be further discussed in Section 3.4.

Impact of a switch to alternative binder on the time path of costs

The estimates of total costs of an RO shown in Table 5 represent annual values. Assuming that costs remain constant over the entire assessment period, the annual estimate (being the annualised present value of costs) coincides with an estimate of the yearly cost. SEAC notes that this only holds if the transition period is excluded from the assessment. A transition period causes additional costs (and emissions), which have to be included in the assessment. Incorporation of the costs and benefits that occur during the transition period is important for:

[17] Cf. Moors et al. (2005), Journal of Cleaner Production 13, 657-668.

i. Providing a comprehensive overview of the costs and benefits associated with the proposed restriction over the entire time period – with the purpose of improving comparability with the proportionality of restrictions that have previously been adopted; and
ii. Enabling a consistent evaluation of restriction options throughout the entire time period – with a view of determining whether the implementation of a transition period is a more cost-effective option than implementation of one of the main restriction options without a transition period.

With a transition period the time path of costs is no longer constant. As a consequence, annual costs depend on the size of the discount rate. Implications of discounting for the assessment of costs are discussed in the SEAC Box in section 2.9. of the Background document.

Assuming that the market for binder is competitive and that production processes have already been established for most alternative binders, it seems justified for SEAC to assume that, after the entry into force of the restriction, marginal costs of binder production will be gradually decreasing over time. Decreasing marginal costs would cause the retail price for alternative binder and, consequently, the market price for clay targets, to decrease over time due to economies of scale. Increasing demand for binders with a low PAH concentration could, on the other hand, also cause the price difference between CTPHT and alternative binders to increase during the assessment period. The size of these effects is difficult to predict and may not necessarily be the same for increasing and decreasing marginal costs.[18] Considering that the price difference between CTPHT and alternative binders is the only time-dependent parameter in the assessment of costs, it is important to understand the implications of price variations on the overall costs associated with restriction options. The Dossier Submitter, therefore, analysed the implications of price variations on costs and, ultimately, proportionality, in a sensitivity analysis (see also Section 3.4 of this opinion).

3.3.2.2. Benefits

Summary of proposal:

The benefits under all restriction options are expressed in terms of avoided environmental emissions, assuming constant emission paths under the baseline and under all ROs. Emissions are expressed as annual values, assuming a discount rate of 4%. The avoided emissions serve as a proxy for assessing the risks to the environment and to humans exposed via the environment. Emissions are assumed to occur predominantly during the article service-life of clay targets, which includes the use phase and the end-of-life phase of clay targets.

Emissions are derived based on estimates of the PAH mass per clay target (i.e. the PAH content times the weight per clay target) multiplied by the number of clay targets used. Furthermore, an initial release of 100% of the 18 indicator PAHs is assumed. In line with the assumptions of a price-inelastic demand, the amount of clay targets consumed is assumed to remain unchanged under all ROs. The expected emission reduction, hence, results from the reduction of the PAH content when switching to an alternative binder. Table 6 shows the expected annual PAH release under the baseline, the annual reduction of releases under the restriction options, and remaining annual releases.

Table 6: Releases to the environment under the baseline and expected reduction of releases under different restriction options

Baseline/Restriction option	PAH concentration	Annual reduction of	Remaining PAH emissions	Incremental emission

[18] See, for example Heim (2021, Asymmetric cost pass-through and consumer search: empirical evidence from online platforms (springer.com), for an analysis of the electricity market.

	[%]	PAH emissions compared to baseline [tons of 18 indicator PAHs/year]	[tons of 18 indicator PAHs/year]	reduction [tons of 18 indicator PAHs/year]
Baseline		0	270	0
RO1	1%	114	156	114
RO2	0.1%	247	23	133
RO3	0.005%	268	2	21
RO4	0.0001%	270	0	2

Total emission reduction is expected to be highest under RO4. In contrast, the incremental emission reduction is highest under RO2. In addition to reducing the environmental pollution burden, all ROs are considered to reduce exposure to humans via the environment. RO2, RO3 and RO4 are also expected to reduce exposure to workers via the reduced production and handling of PAH containing clay targets. The Dossier Submitter assumes the reduction of exposure of workers to be proportional to the 18 PAH content in clay targets.

SEAC conclusion(s):

SEAC agrees with the approach for determining annual emissions but notes that annual emissions may be subject to over- or underestimation. The Dossier Submitter discusses possible reasons for an over-or underestimation of emissions. Specifically, annual emissions could be lower if a fraction of clay targets is removed from the environment (i.e. broken fragments are collected for disposal after use). There is currently no evidence on the fraction of clay target recovery. SEAC agrees with the Dossier Submitter that, even if a certain fraction of clay target fragments is collected at shooting ranges, this would lead to additional exposure of consumers and will only postpone emissions to the environment (e.g. when clay targets are deposited on land-fills). In contrast, the release of PAHs from CTPHT and other identified binders (petroleum pitch, petroleum resin and other resins containing PAHs) to the environment can potentially be underestimated because the exact identity and PAHs composition of the substances and their use in clay targets is not known. Finally, emission estimates do not include emissions occurring during the production process of clay targets.

In addition, SEAC notes that, as for the assessment of costs, the assessment of the (avoided) emissions under different ROs should include impacts occurring during the transition period.

As mentioned above, operators of fixed clay target shooting ranges on land have the option to dispose of clay target shards. SEAC anticipates in this respect that waste from CTPHT clay targets would currently be declared hazardous waste and would, therefore, require expensive disposal as hazardous waste. Unfortunately, neither the Dossier Submitter nor companies or the general public addressed this point in the consultation. With the implementation of a restriction, the sum of indicator PAHs would be < 0.005 mg/kg and disposal would become at least easier, perhaps even cheaper, in accordance with the relevant waste regulations of the Member States. The assumption is based on the fact that the clay target waste with its 66% limestone can possibly be treated comparably to simple construction waste, because the remaining proportion of indicator PAHs will be less than 0.005% (=50 ppm) in the future. As such, an additional benefit of the proposed restriction could be a reduction in disposal costs. Without information on waste quantities and disposal costs, SEAC can, however, not provide a quantitative estimate of possible reduced disposal costs.

Key elements underpinning the SEAC conclusion(s):

The Dossier Submitter discusses possible reasons for an over- or underestimation of emissions. Specifically, annual emissions will be underestimated if a fraction of clay targets is removed from the environment (i.e. broken fragments are collected for disposal after use). There is currently no evidence on the fraction of clay target recovery. Unless further information becomes available (e.g. from the results of the consultation on the Annex XV report), SEAC assumes the clay target recovery is marginal and can be ignored in the assessment. In contrast, the release of CTPHT and other identified binders (petroleum pitch, petroleum resin and other resins containing PAHs) to the environment can be potentially underestimated because the exact identity of the substances, their full composition in PAHs, and their use in clay targets is not known. Moreover, emission estimates do not include emissions occurring during the production process of clay targets. The impact of these uncertainties on annual emission values is analyzed with a sensitivity analysis (see also Section 3.4), illustrating that an over-or underestimation of PAH emissions can reduce or increase the cost-effectiveness of the different restriction options considered. SEAC notes that, since the C/E ratios of all restriction options considered would be affected in the same way, the list and the order of cost-effective options would not change.

It seems plausible to SEAC to take a reduction of environmental emissions as a proxy for the reduced short-term exposure of humans via the environment. SEAC notes, however, that using indicator PAHs as a proxy for the expected exposure reduction of workers is highly sensitive to the number of PAH indicator substances considered. Hence, the expected reduction of health impacts for workers may be higher or lower depending on how many PAH indicator substances are used.

As for the cost side of the assessment, SEAC notes that considering a transition period has implications on the assessment of (avoided) emissions. In particular, as explained by the Dossier Submitter, a transition period will lead to a prolonged use of clay targets with a higher PAH content of the binder, in particular petroleum pitch and petroleum resin. This causes additional emissions during the first year of the assessment period. SEAC notes that this may change the total expected emission reduction under each restriction option. A more detailed discussion of the implications of the transition period on the proportionality of the restriction proposal is provided in Section 3.3.2.4.

3.3.2.3. Other impacts

Summary of proposal:

In addition to economic impacts (costs in terms of consumer surplus loss under either of the ROs and producer surplus losses), avoided environmental impacts (expected emission reduction under a RO) and avoided impacts to human health via the environment, some of the suggested ROs are assumed to cause other impacts which are discussed qualitatively in the restriction proposal.

Natural resin as binder is, for example, considered to not fully meet the quality requirements when used in clay targets (higher breakability of clay targets when used in high temperature). Due to lacking information, this impact on the quality of clay targets are discussed qualitatively but were not included in the assessment of cost-effectiveness.

SEAC conclusion(s):

SEAC notes that the potential lower quality of clay targets using natural resin (in particular their lower thermal resistance) may cause an additional loss in consumer surplus, which is, however, difficult to quantify.

Key elements underpinning the SEAC conclusion(s):

According to the Dossier Submitter, an annual volume of approximately 13 000 tonnes would be required for the production of clay targets used in Europe if natural or pine rosin alone

would be used as a binder. Due to lacking information, the Dossier Submitter could not conclude whether this amount would be readily available in case of a restriction. However, there is evidence from industry that the availability of eco- and natural resins in relation to RO3 is not considered a significant issue. This is underlined by information provided by several clay target producing companies, who advertise natural resin-based clay targets on their websites.[19] While it is principally plausible to assume that there can be shortages of natural resin in the first period after entering into force of the restriction, SEAC considers it unlikely that these shortages will be of a long-term nature or even lead to market disruption given the information about current supply of natural resin as binder material and considering that there is no evidence for a lack of capacity for upscaling production. The potential for additional consumer surplus losses due to changes in quality when natural resin is used as binder is important to consider.

3.3.2.4. Overall proportionality

Summary of proposal:

The proportionality assessment of the four selected ROs is informed by cost-effectiveness analysis. Table 7 presents a comparison of restriction options based on their cost-effectiveness and incremental cost-effectiveness (C/E) ratios.

Table 7: Comparison of restriction options as evaluated by the Dossier Submitter

Restriction option	Total annual costs [€ million/year]	Total annual emission reduction [tons of 18 indicator PAHs/year]	C/E ratio [€/kg]	Incremental change in costs [€ million/year]	Incremental emission reduction [tons of 18 indicator PAHs/year]	Incremental C/E ratio [€/kg]
RO1	0.0	114	0.5	0.1	113	0.5
RO2	0.9	247	3.8	0.9	133	6.6
RO3	3.6	268	13.5	2.7	21	130.0
RO4	5.5	270	20.8	2.0	2	952.4

The C/E ratio increases subsequently from RO1 to RO4, reflecting increasing average costs per kg of PAH abatement in relation to the baseline. For comparing ROs, the incremental C/E ratio and information about marginal costs of PAH abatement of a RO in comparison to the next cheaper alternative, have to be used. According to the assessment, both average and marginal abatement costs increase considerably between RO2 and RO3, and are highest for the option of using PAH-free binder (RO4).

Based on the assessment, the Dossier Submitter proposes RO3 to be the preferred option. This is motivated as follows:

(i) Significantly higher effectiveness compared to RO2 and RO1 - RO3 leads to a reduction of yearly emissions of about 99%.

(ii) There seems to be sufficient availability of eco resin in the EU to meet the demand for binder such that the amount of clay targets produced annually remains unchanged. According to the Dossier Submitter, EU based clay target producers are already

[19] Cf. THE ECONOMY AND THE RISING COST OF CLAY TARGETS - Corsivia; Resin Natural – LAPORTE CLAY TARGET INDUSTRIES; Targets Vivaz - Ecological clay targets (platosvivaz.com).

producing eco-friendly clay targets, and an industry source claims that, in theory, the resulting excess demand of eco-friendly clay targets could be served by a single EU producer, it is assumed that most of the eco-targets sold in EU would also be produced in the EU. Compared to the baseline, this could have positive producer surplus impacts.

(iii) Practicality and monitorability: RO3 aligns with the rules of the International Sports Shooting Federation (ISSF), which impose a limit of 0.005 % w/w for the sum of 18 indicator PAHs in clay targets, and which has been adopted for the Olympic Games, World Championships, World Cups, World Cup Finals and Junior World Cups. This is seen to provide a clear legal basis for companies and enforcement authorities that is consistent with already existing rules in the sector.

(iv) The (average) C/E ratio of all ROs (column 4 in Table 7) is at the lower end of C/E ratios assessed in other, recent REACH Annex XV restriction dossiers. RO3 is considered the preferred option because it leads to an emission reduction of about 99% while its incremental C/E ratio is still within the range of C/E ratios of other restriction dossiers, and also below suggested benchmark values.

Table 8: Cost-effectiveness of recent REACH restrictions

Restriction under REACH	**€/kg p.a., central value**
Lead in shot in wetlands	9
Lead in PVC (under opinion making)	308
D4, D5 in wash-off cosmetics	415
DecaBDE	464
Phenylmercury compounds	649
PFOA-related substances	734
PFOA	1 649

Furthermore, the Dossier Submitter proposes a transitional period of one year after entry into force of the restriction. During this period, clay target producers will be allowed to use binder with a PAH concentration of max. 1%, based on the use of 18 PAH indicator substances. This means that during the transition period either petroleum pitch (PAH concentration 0.8%), petroleum resin (PAH concentration 0.07%), eco resin (PAH concentration < 0.005%) or natural resin (PAH concentration 0%) can be used. Petroleum pitch is the cheapest option (no price difference with CTPHT).

The Dossier Submitter sees a need for such a period in order to avoid any shortage of useable clay targets in the EU, and thus additional consumer producer surplus losses. The Dossier Submitter considers a one-year transitional period sufficient to allow clay target manufacturers to find suppliers of those binder materials that are not under the scope of the proposed restriction, and to enable clay target producers to implement any adjustments to their manufacturing processes. However, the transitional period is estimated to lead to additional emissions of up to 150 tonnes of the 18 indicator PAHs.

The assessment of the average and incremental cost-effectiveness does not include possible impacts during the transition period. According to the Dossier Submitter, these impacts are uncertain because it cannot be predicted what binder clay target producers will choose in this period. Furthermore, the Dossier Submitter considers it likely that many clay target producers will substitute to binder materials that are not under the scope of the full restriction before the transitional period is over, i.e. eco resin and natural resin. However, it is not clear how many producers will substitute to those binder materials that are not under the scope of RO3 even before the transitional period is over. Due to these uncertainties, the impacts of the transitional period were described qualitatively. Finally, annual impacts also represent costs

and emissions avoided over an extended timeline (e.g., 20 years starting in the first year after the transition period), and apply the same discount rate to both costs and emission reduction (i.e. 4%).

RAC and SEAC conclusion(s):

Considering the assumptions made about the market for binder material and for clay targets, and the existing data and qualitative information regarding costs and avoided emissions of the ROs, SEAC agrees with the Dossier Submitter that using eco-resin after a one-year transition period (i.e. banning CTPHT, petroleum pitch and petroleum resin as suggested by RO3) can be considered proportionate. SEAC notes that using natural resin after a one-year transition period as suggested under RO4 can in principle also be considered proportionate. This conclusion considers the high persistence of PAHs, causing the environmental pollution stock to increase over time if emissions continue, and their well-established hazard profile, and that both restriction options achieve a very high reduction of PAH emissions (98% and 100%, respectively), and therefore minimise the (future) risk of environmental and human health impacts from clay target shooting. Moreover, the C/E ratios are far below C/E ratios presented in other restriction dossiers addressing chemicals with PBT/vPvB properties. SEAC remarks that the C/E ratios of previous restrictions cannot be directly compared to C/E ratios of the restriction options evaluated in this dossier, for example due to differences in the assumptions for estimating costs and avoided restrictions. SEAC further remarks that C/E ratios of previous restrictions cannot serve as precise benchmarks to which C/E ratios of restriction options can be compared. Still, C/E ratios of earlier dossiers addressing PBT/vPvB chemicals provide an indication of the order of magnitude of costs for the avoidance of emissions that have been considered tolerable to society. If a transition period is adopted, SEAC notes that using petroleum pitch during the transition period (as suggested under RO3) does not appear to be cost-effective. Instead, according to SEAC's analysis which is further discussed below, it appears cost-effective to use petroleum resin (i.e. banning CTPHT *and* petroleum pitch) prior to switching to eco-resin, or to use eco-resin in a transition period prior to switching to natural resin.

In the absence of empirical benchmarks for the restriction options evaluated in this dossier, SEAC highlights further arguments that are relevant for the choice of the restriction option. In particular, the incremental C/E ratio, expressing the additional costs required for avoiding the last 2 tonnes of annual emissions, is considerably higher when all binder except natural resin are banned as proposed under RO4 (952 €/kg compared to 130 €/kg). Furthermore, the short-term availability of binder available under RO4 (where only natural resin could be used) is more uncertain than under RO3 (where principally both eco resin and natural resin could be used). In the view of SEAC it is unlikely that this will – under market conditions as outlined in the restriction proposal– lead to significant problems or distortions on the market for clay targets considering that producers seem to overproduce clay targets using all types of binder to avoid any shortage of clay targets on the market.[20] Besides availability, the quality of natural resin seems to be lower compared to other alternative binder because of its possible softening at high temperatures. Therefore, annual costs of RO4 could be higher than estimated based on the retail price difference, which would increase the difference in total costs between RO4 and compared to RO3. SEAC notes that if, and how, this would affect the average C/E ratio of RO4 compared to RO3, is uncertain, but could be explored by means of a sensitivity analysis.

In the view of SEAC, a transition period would be justified if the costs during this period can be assumed to be structurally different compared to costs after the transition period. This would be the case if clay target producers face substantial switching costs. In the communication with SEAC Rapporteurs the Dossier Submitter explained that some clay target producers may be affected by such very high switching costs due to (i) adjustments of their production processes, (ii) additional time needed to learn how to use eco binders in the

[20] THE ECONOMY AND THE RISING COST OF CLAY TARGETS - Corsivia.

production of clay targets, and (iii) the need to find new suppliers of binder material. According to the Dossier Submitter, this could potentially lead to short-term shortages of useable clay targets. While SEAC acknowledges that an immediate switch to eco- or natural resin can, principally, cause additional costs for clay target producers, SEAC has doubts whether these costs are substantial enough to justify a transition period:

- The argument of high switching costs seems inconsistent with the information provided in the restriction proposal explaining that, at EU level, sufficient binder meeting the requirements of RO3 can be provided. According to stakeholder information provided during the preparation of the restriction proposal, the availability of eco resins and natural resins is not considered a significant issue. In addition, SEAC notes that the transformation process of the market for clay targets towards using eco-friendly binder is already ongoing due to the increasing regulatory pressure on phasing-out CTPHT and the decision of the Commission of 16 March 2022 to not grant authorisation for the use of CTPHT as a binder in the manufacture of clay targets. SEAC, therefore, considers it reasonable to assume that the impacts of an immediate restriction (i.e. without a transition period) on consumer and producer surplus may be small provided that there is no substantial shortage of eco resin and natural resin, and that the restriction can, therefore, be considered affordable for both producers and consumers (shooters).[21]
- One comment provided in the consultation (#3578) expressed a concern about the short-term availability of eco-resin and natural resin. The supply of both binders could decrease even further because of the trade sanctions on Russia, which is, besides the UK, an important provider of these resins. This could potentially indicate a risk of a larger or longer term shortage of eco-friendly binder. Unfortunately, no information (e.g. market data or costs) was provided to further substantiate this comment. Therefore, SEAC cannot evaluate the severity of this risk. Furthermore, it is unclear to SEAC if and to what extent a shortage of eco-friendly binder from Russia can be compensated by an increased supply of this binder in the EU, for instance by an expansion of "crude tall oils" (CTO, a raw material generated in the wood pulp production process and used for at least some eco- and natural-resins), or by increased imports from the UK. Based on two comments received (#3578 and a further confidential comment) there is a possibility that the market availability for low-PAH binders could be better for some companies with well-established supply chains. This could mean that that RO3 and RO4 could lead to asymmetric impacts between clay target producers in the EU so that some clay target producers could even face problems with continuation of their business, while some clay target manufacturers could increase their market share. SEAC agrees with the Dossier Submitter in that these problems could be mitigated with a longer transitional period, however, this would also imply that high PAH-releases would continue, leading to an on-going accumulation of PAHs in the environment, and to a growing potential for negative and potentially irreversible impacts to ecosystems and humans. Furthermore, the concerns raised in the Public Consultation were not further substantiated.[22] To be able to evaluate the likelihood of such worst-case scenarios, SEAC would welcome information on both issues (i.e. the possibility to compensate shortages in the supply of low-PAH-binders from Russia, and the risk of closing of business) to be provided during the consultation on the SEAC draft opinion.
- If a transition period is adopted, the additional costs and emissions arising during this period need to be included in the cost-effectiveness analysis of restriction options. This changes the assessment of total annual costs and total annual emissions avoided under the restriction options, and the cost-effectiveness of restriction options. According to

[21] It is explained in the restriction proposal that the largest producers in the EU already produce the vast majority of their targets using either petroleum resin, eco resin or natural resin as binder materials" (p.36). Furthermore, the clay target market is already substituting to eco resin-based clay targets, with many producers only marketing/producing them, and many shooting clubs having already switched to shooting only eco-friendly clay targets" (p.42). Also, the restriction proposal explains that the price difference between eco-friendly clay targets and standard (i.e. CTPHT based) clay targets is 1.4 cent, which leads to an increased cost per season of 35 euros for an average shooter (see p.56). According to stakeholder information, this increase in the price of shooting is relatively low compared to the other costs of the sport.

[22] SEAC notes that several clay target producers underline the availability of eco-friendly or even PAH-free clay targets on their websites. See, for example, https://platozvivz.com/en; https://cci-international.com/eco-clay/.

SEAC's own assessment, which is added as a SEAC box to Section 2.9 of the Background Document, the preferred option suggested by the Dossier Submitter (i.e. banning the use of CTPHT during the transition period, and extending the ban to petroleum pitch and petroleum resin as well as other resins containing PAH at a concentration above 0.005% thereafter (RO3)), does not appear to be cost-effective. Instead, it is more cost-effective to ban both CTPHT and petroleum pitch (RO2) during the transition period and to extend the ban to petroleum resin thereafter (RO3). According to SEACs assessment, this combination of measures has a C/E ratio of 12.9 Euro/kg The annualised costs do not differ significantly from costs for RO2 when being adopted in year 2 as initially assumed by the Dossier Submitter. The impact of uncertainty related to this issue on SEAC's analysis is further discussed in Section 3.3.2.5.

SEAC also investigated the option of immediately banning CTPHT, petroleum pitch and petroleum resin (RO3), i.e. implementing the restriction option recommended by the Dossier Submitter after the first year, immediately. The C/E ratio of this option is 13.5 Euro/kg emissions avoided. The difference compared to the C/E ratio of the option banning CTPHT & petroleum pitch (RO2) in the transition period can be explained by higher costs but also a higher emission reduction in year 1. However, SEAC notes that the incremental C/E ratios are the same for both options. Considering further that the average C/E ratios of both restriction options are far below the C/E ratios of previous restriction dossiers, **SEAC proposes to adopt RO3 immediately** and to change the entry text of the restriction accordingly. Taking the uncertainty related to the availability of eco resin and natural resin in light of the trade sanctions on Russia into account, SEAC notes, however, that a transition period of one year could be reasonable under these circumstances in order to provide sufficient time for upscaling the production of eco and natural resin, or to increase imports into the EU (e.g. from the United Kingdom). In this case, **banning CTPHT & petroleum pitch (RO2) in the transition period, and implementing RO3, which also bans petroleum resin, thereafter, is also a cost-effective option**. SEAC notes that this option dominates the option which was initially proposed by the Dossier Submitter (i.e. banning only CTPHT in the transition period (RO1) in combination with using eco resin thereafter (RO3), see Figure 1). The reason is that 'RO2+RO3' achieves a higher total emission reduction at comparable cost (see also Table 2 in the SEAC Box added to Section 2.9 of the Background Document). While SEAC acknowledges that an earlier ban of petroleum pitch (i.e. RO2 adopted already during the transition period) or an earlier ban of petroleum pitch and petroleum resin (i.e. RO3 adopted already during the transition period) may cause additional costs for clay target producers, SEAC considers it unlikely that these costs are so substantial that this would change the rank order of option as shown in Table 1 of the SEAC Box. The reasons are discussed in the next section below and in Section 3.3.2.5. SEAC also notes that for petroleum resin no scarcity has been reported at EU level, which implies that sufficient binder is already available to allow for an implementation of RO2.

Key elements underpinning the RAC and SEAC conclusion(s):

Relevance and implications of the transition period

The main reason for proposing a transition period is to immediately prevent the import and use of CTPHT in the EU while avoiding a potential disruption of the market for clay targets and a shortage of usable clay targets due to a short-term scarcity of binder, in particular natural resin. Furthermore, the transition period intends to ensure that clay target producers can implement any required adjustments to their manufacturing processes. Given the existing evidence and the qualitative information provided in the restriction proposal, SEAC considers it rather unlikely that the impacts of the restriction will indeed be so drastic that a transition period is required:

- Alternative binder materials which can meet low PAH concentrations that have already been imposed by the ISSF are available and in use. It is explained in the dossier that nearly 30 % of targets are already produced with various eco resins as binder.
- For the use of eco resin, considering the information about the market for this binder provided in the restriction proposal, SEAC considers it realistic that sufficient binder

can be produced for meeting the demand for clay targets as assumed in the dossier, even under a full ban of petroleum pitch, petroleum resin and other PAH-containing resin binders above the concentration limit of 0.005%. While a short-term shortage of natural resin could occur due to the need for upscaling the production of binder, SEAC does not see evidence that this will lead to long-term scarcity or even a disruption of the European market for clay targets. Considering that it seems a default strategy of some clay target manufacturers to produce more than 100% of the actual demand in order to be able to buffer market uncertainty (e.g. price variations of input material)[23], SEAC assumes that a short-term shortage of eco-friendly clay targets, i.e. clay targets with a PAH concentration below 0.005%, which applies to clay targets produced with eco resin or natural resin as a binder, can be compensated by existing stocks.

- According to stakeholder information, clay target producers have in the past been frequently required to adapt to a changing availability of raw materials and price variations. Furthermore, due to the increasing regulatory pressure to switch from CTPHT as binder material to other binders with a lower PAH content, the transformation process is already on-going. SEAC, therefore, considers it unlikely that substantial barriers (such as the need for major additional capital investments, upscaling of a new, unproven technology, lacking knowledge infrastructure), which could induce substantive additional costs to clay target producers, exist which could hamper an earlier ban of CTPHT and petroleum pitch already during the transition period (i.e. RO2).
- SEAC notes that there is some uncertainty about the short-term availability of eco- and natural resin as a result of trade sanctions on Russia. Provided that trade sanctions on Russia also include eco- and natural resins, and that the reduced availability of these binders from Russia cannot be compensated by other suppliers within or outside the EU, an immediate switch to eco- or natural resin (i.e. adopting RO3 already in year 1) could substantially increase production costs for clay target producers, and retail prices of clay targets. As discussed earlier, SEAC considers a transition period in this case justified.

Proportionality of restriction options

A transition period changes the evaluation of restriction options. Additional costs and additional emissions occurring during this transitional time have to be included in the assessment of cost-effectiveness as this is important for:

i. Providing a comprehensive overview of the costs and benefits associated with the proposed restriction over the entire time period – with the purpose of improving comparability with the proportionality of restrictions that have previously been adopted; and
ii. Enabling a consistent evaluation of restriction options throughout the entire time period – with a view of determining whether the implementation of a transition period is a more cost-effective option than implementation of one of the main restriction options without a transition period.

Specifically, two periods are relevant for assessing total costs and benefits of the restriction options; (i) period 1, being the transition period in which CTPHT is banned, and (ii) period 2, being the remaining time of the assessment period in which clay target producers have to switch to binder complying to PAH concentration limits of RO1-RO4. Therefore, a particular RO is a *progressive path* of measures for replacing PAH-containing binder, and the assessment of cost-effectiveness of restriction options must cover the entire time path of this replacement process. Consequently, total annualised costs and benefits of either restriction option consist of (i) the costs and the emissions avoided during the transition period *and* (ii) the costs and emissions avoided in the period thereafter.

[23] Cf. THE ECONOMY AND THE RISING COST OF CLAY TARGETS - Corsivia.

SEAC notes that a transition period suggesting a PAH concentration limit per clay target cannot be defined a priori but should result from the assessment. Besides the Dossier Submitter's proposal to adopt a PAH concentration limit of 1% during the transition period (reflecting RO1), PAH concentration limits could also be lower (i.e. 0.1%, 0.005%, or 0.0001%, reflecting RO2-RO4). While a stricter PAH concentration limit in the first year would be more costly, it would save more PAH emissions early on. In the view of SEAC, the cost-effectiveness analysis of restriction options should provide a transparent picture of the expected costs and avoided emissions of all relevant combinations of measures in order to identify the combination of measures which can be considered cost-effective (i.e. which are not dominated by other combinations of measures achieving a certain total emission reduction with similar or lower costs), and from which a decision-maker can choose.

SEAC acknowledges that there is uncertainty regarding the actions taken by clay target producers during the transition period. Clay target producers could, for example, switch immediately to binder with a lower PAH concentration. A descriptive discussion of relevant uncertainties, as provided by the Dossier Submitter, is therefore useful. Still, SEAC considers it not appropriate to fully decouple expected costs and benefits occurring during the transition period from the assessment. Specifically, considering that plausible assumptions were made to frame the assessment of RO1-RO4, and that quantitative information on costs and emissions under all options is available, the implications of the transition period for the ranking of restriction options should be made transparent in the CEA framework by using plausible scenarios or a break-even analysis.

Considering the arguments above, SEAC conducted its own assessment based on the data and the qualitative information provided in the Background Document. SEAC's assessment deviates from the assessment in the Background Document in that costs and benefits of the transition period were included in the cost-effectiveness analysis of restriction options. Total annual costs, avoided annual emissions, average and incremental cost-effectiveness ratios of relevant combinations of measures are shown in the SEAC Box which has been added to Section 2.9 of the Background Document. The results of SEACs assessment can be summarised as follows:

- With a transition period, and assuming that CTPHT will no longer be available, clay target producing companies will likely switch to the least expensive alternative binder, i.e. petroleum pitch. This is in line with the assumptions made in the Background Document for assessing RO1-RO4. SEAC notes that clay target producers can, principally, already switch to other alternative binder materials with an even lower PAH concentration earlier, i.e. already before the end of the transition period. However, in order to be consistent with the assumptions adopted by the Dossier Submitter for the evaluation of ROs in the remaining time period, and in the absence of further evidence, SEAC suggests to use 156 tons PAHs per year as estimate of additional emissions that would occur during the transition period if CTPHT is banned (based on the assumed 18 indicator PAHs). This corresponds to RO1.
- Based on SEAC's assessment, the option proposed in the dossier (RO1 in year 1, RO3 in the remaining years of the assessment period) does not appear to be cost-effective. With a total annual emission reduction of 257 tons and total annual costs of €3.4 million, this option has an average C/E ratio of 13.1 Euro/kg of avoided emissions. The incremental C/E ratio[24], is €241/kg of avoided emissions. Assuming that basic assumptions about the market structure and the behaviour of clay target producing firms prevail, and that possible additional costs due to an earlier ban of petroleum pitch are minor, it appears more cost-effective to ban CTPHT & petroleum pitch (RO2) during the transition period, and implement RO3, which also bans petroleum resin, thereafter. The reason is that the combination 'RO2+RO3' reveals a higher annual emission reduction (266 tons) at

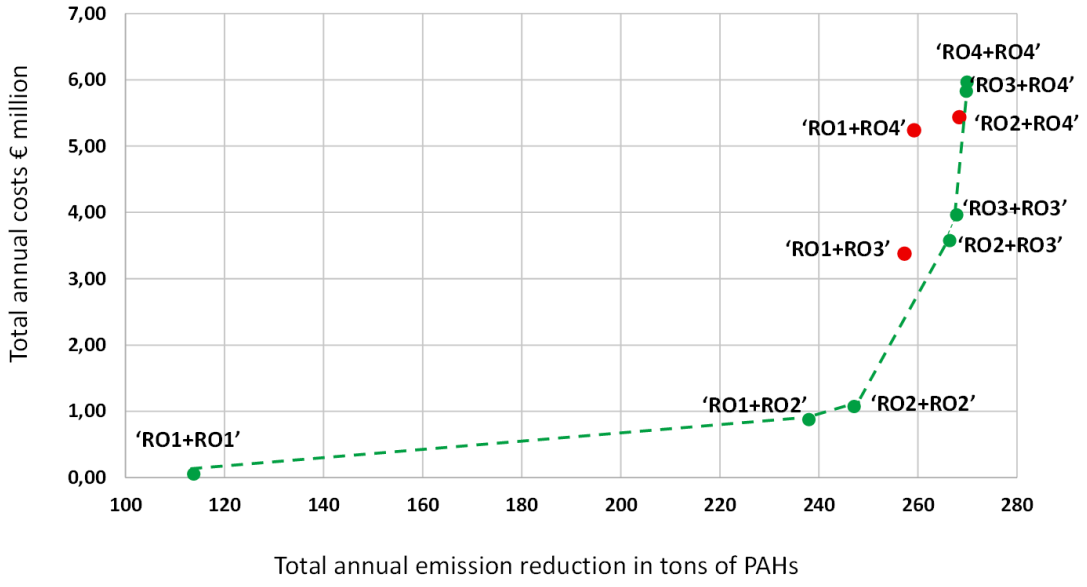
[24] These are the costs for avoiding additional annual emissions of 10 tonnes (257 tonnes instead of 247 tonnes, see table 1 in the SEAC Box added to the Background Document)

comparable annual costs (€3.4 million). The combination 'RO2+RO3' is, therefore, less expensive per kg of emissions avoided (€12.9/kg of avoided emissions) than the combination 'RO1+RO3' (€13.1/kg of avoided emissions). SEAC also notes that according to SEAC's own assessment none of the other possible scenarios in which petroleum pitch is used during the transition period, followed by using either eco or natural resin thereafter appears to be cost-effective.

- When RO3 is implemented immediately, the C/E ratio is slightly higher compared to a situation in which RO2 is implemented during the transition period (€13.5/kg of avoided emissions compared to €12.9/kg of avoided emissions). While implementing RO3 immediately is more expensive (at a cost of €3.6 million compared to €3.4), it also leads to a higher emission reduction compared to banning CTPHT and petroleum pitch (RO2). Therefore, the marginal cost-effectiveness is the same for both options (€130/kg of emissions avoided). Considering further that the average C/E ratios of both restriction options are far below the C/E ratios of previous restriction dossiers, **SEAC proposes to adopt RO3 without a transition period** and to change the entry text of the restriction accordingly. **If there is evidence on substantial shortages of eco or natural resin, e.g. due to the trade sanctions on Russia, SEAC proposes to adopt RO2 during the one-year transition period, and RO3 (i.e. a ban of CTPHT, petroleum pitch and petroleum resin) thereafter.**

Based on SEAC's assessment, the abatement cost curve for the progressive combinations of measures is shown in Figure 1 below where the red dots illustrate restriction options that are strictly dominated by other combinations of measures, which result in a higher annual emission reduction at a similar or lower cost. Green dots illustrate the restriction option combinations that a decision-maker can choose from. SEAC notes that, while all combinations of restriction options indicated with green dots can be considered cost-effective, they may not be equally appropriate. For example, the combination 'RO1+RO4' could be less feasible due to uncertainty about the availability and quality of natural resin for the production of clay targets. In contrast, while the combination 'RO1+RO1', 'RO1+RO2' and ' RO2+RO2' appear to be feasible given the assumptions made in the Dossier, these options do not achieve the PAH concentration limit proposed and, therefore, the reduction of environmental pollution envisaged by the Dossier Submitter.

Figure 1: Abatement cost curve of different restriction options as evaluated By SEAC



Discounting

For evaluating the proportionality of different restriction options based on cost-effectiveness

analysis, the Dossier Submitter used a social discount rate of 4% for both costs and avoided emissions. SEAC notes that this approach deviates from previous restriction dossiers addressing PBT/vPvB substances, which used 0% for avoided emissions. This implies that the quantitative results of the assessment, in particular C/E ratios, cannot directly be compared with C/E ratios of previous restrictions. SEAC acknowledges that REACH guidance specifies the use of a discount rate of 4% but highlights that a tendency to use lower social discount rates has developed worldwide over recent years. SEAC, therefore, considers a 4% discount for costs to be too high. The most recent version of the 'Better Regulation Guidelines and Toolbox' published by the European Commission, for example, proposes using a discount rate of 3% in real terms for market goods (EC 2021, p. 554).[25]

SEAC does not conclude on the appropriateness of the use of a positive social discount rate for emissions in the analysis. SEAC notes however, as it is also pointed out in the EU Better regulation Guidelines and Toolbox, that it is common practise in many countries to choose a lower rate for health or environmental impacts. SEAC also notes that the choice of the discount rate for costs and emissions influences the size of annualised costs and emissions and, therefore, the results of the cost-effectiveness analysis. Therefore, SEAC evaluated the robustness of the Dossier Submitter's restriction option analysis, as well as SEAC's analysis considering the impacts during the transition period, by means of a sensitivity analysis using a discount rate of 0% for emissions. Further details of SEAC's evaluation of the implications of the choice of discount rates are provided in a SEAC Box added to Section 2.9 of the Background Document. In summary, the use of a 0% discount rate for emissions results in lower cost-effectiveness ratios for all combinations of restriction options. SEAC's conclusions on the most appropriate RO to be implemented remain unaffected by the use of a different discount rate.

3.3.2.5. Uncertainties in the proportionality section

The Dossier Submitter proposes a one-year transition period in order to avoid any shortage of binder in the EU and, related to this, a shortage of useable clay targets in the EU. In the communication with SEAC, the Dossier Submitter also explained that some clay target producing companies may face difficulties to fully adapt their production technologies to new binder materials prior to the entry into force of the restriction. This could mean that, in the short-term, some clay target suppliers could face extraordinarily high additional costs due to an insufficient availability of binder, high substitution costs, and, in a worst case scenario, would have to terminate their production of clay targets for the EU market.

According to SEAC's assessment, a ban of CTPHT & petroleum pitch (RO2) during the transition period, and the implementation of RO3 thereafter, remains a more cost-effective option than the combination 'RO1+RO3' even if costs in year 1 are assumed to increase by 100% (i.e. they become twice as high as annual costs of RO3 (=€7.2 Mio)). While can, of course, only be a first indication of the influence of potentially higher substitution costs on the cost-effectiveness and proportionality of restriction options, it illustrates that cost-effectiveness ratios are fairly robust. Considering further that petroleum resin is sufficiently available, and that the use of petroleum resin does not impact the quality of clay targets produced, it seems justified for SEAC to assume that additional costs due to banning CTPHT and petroleum pitch and using petroleum resin already during a one-year transition period (RO2) are minor and will not affect the order of restriction options according to cost-effectiveness.

During the consultation, one company (Comment #3578) noted that smaller companies may be particularly affected by high substitution costs if the PAH content will be < 0.005% (corresponding to a ban of CTPHT, petroleum pitch and petroleum resin, i.e. RO3).

[25] Cf. European Commission (2022): Better regulation: guidelines and toolbox | European Commission (europa.eu).

Unfortunately, the company did not provide any further evidence for this. SEAC, therefore, considers such a worst-case scenario unlikely to occur at a large scale. Still, SEAC acknowledges that there is uncertainty regarding the state and the speed of the transformation process towards producing eco-friendly clay targets. It can therefore not be ruled out that the total costs associated with RO3 are higher in the short-run than assumed due to a higher (than assumed) magnitude of substitution costs. SEAC also supports the view expressed by the Dossier Submitter that additional substitution costs and producer surplus losses, if they occur, might be asymmetrically distributed within the EU. In the view of SEAC, however, this does not necessarily mean that small(er) companies would be affected more severely compared to large clay target-producing companies. Rather, considering the existing regulatory pressure on phasing-out the use of CTPHT due to the decision of the Commission of 16 March 2022 to not to grant authorisation for the use of CTPHT as a binder in the manufacture of clay targets, substitution costs during the transition period may be expected to be particularly high for companies who have not yet started to adapt their production processes at the entry into force of the restriction.

While SEAC acknowledges that impacts of the restriction may be asymmetrically distributed among clay target manufacturers within the EU, SEAC does not consider the occurrence of significant impacts on some companies, which have not taken proactive action to switch to the production of eco-friendly clay targets, for which demand already exists, to be a sufficient justification for a transition period. If a transition period is adopted, SEAC proposes a lower PAH content in this period, i.e. 0.1% instead of 1%, which corresponds to banning CTPHT *and* petroleum pitch (RO2) already in year 1.

3.3.3. Practicality, incl. enforceability

Justification for the opinion of RAC and SEAC

Summary of proposal:

The Dossier Submitter considers that it is practical to base a limit on a measurable and well-known PAHs that serve as indicators for the presence of other PAHs. The proposed restriction option is aligned with the rules of the ISSF, which impose a limit of 0.005 % w/w for the sum of 18 indicator PAHs in clay targets for their competitions. The Dossier Submitter considers that sampling of clay targets and sample preparation is relatively straightforward, as the matrix is rather simple (binder and filler) and homogeneous, and that calibration standards and analytical methods are readily available for the targeted 18 PAHs.

In terms of the other main criteria for a restriction, practicality and monitorability, the Dossier Submitter sees all restriction options as equivalent.

RAC and SEAC conclusion(s):

RAC and SEAC support the view of the Forum that the proposed restriction will be enforceable provided that a specific state-of-the art analytical method is developed defining the necessary harmonised testing approach by the time it enters into force.

RAC supports the view of the Forum that it can be expected that the techniques currently in use for the identification and quantification of PAHs in general could be adapted for identification and quantification of the 18 indicator PAHs and 3 recently classified PAHs (Carc. 1B) in clay targets with a suitable limit of detection (LOD).

RAC supports the view of the Forum that it is preferable to set a permanent number of PAHs for the enforcement of the restriction rather than implementing a dynamic link to CLP regulation and the Candidate List REACH regulation to update the list of PAHs in order to avoid the need to update constantly the analytical method.

RAC notes that the proposed restriction will contribute to meet the objectives of the POP regulation for PAHs.

Key elements underpinning the RAC and SEAC conclusion(s):

The RAC and SEAC assessment takes into account the Forum Advice, made available to Committees on 3 May 2022, and Forum responses to questions from rapporteurs. The Forum noted that the Background Document referred to several articles about analysing PAHs and to the Compendium of analytical methods, but that no standard and validated method (ISO or CEN methods) for the analysis of the 18 indicator PAHs in clay target is described. Following the Forum Advice, the Dossier Submitter has updated the Background Document to include information on the sampling, samples preparation, extraction method and analytical method based on the national restriction in Austria and the German methods AfPS GS 2014:01 and AfPS GS 2019:01, which are also used by industry to check compliance with the ISSF rule.

The sampling of clay targets (e.g. buying articles available in the market) is not foreseen to cause any problems. Clay targets can easily be collected from manufacturers, retailers or shooting ranges and analysed.

Although there is not currently a specific method for all listed PAHs, it seems feasible a new working method can be proposed with due consideration for the specific matrix type and the specific PAH pattern in question. RAC and SEAC, therefore, considers the proposed restriction for PAHs in clay targets for shooting to be enforceable. The enforceability is affected by the matrix and the availability of a validated method covering all the listed PAHs (including availability of reference materials and of deuterated standards for each PAH analysed). RAC agrees with the Forum that there is a need for a specific certified reference material (CRM) based on ground clay pigeons for the proposed restriction by the time it enters into force.

Forum is promoting a German method, AfPs 2014:01 PAK, that has often been used to analyse the 18 indicator PAHs in compliance with the requirements of the Product Safety Act for the award of the GS mark. However, this particular method is intended to be used for plastics, rubber, cosmetics etc. and not for the type of matrix in clay targets. Since 10 April 2020, this method is reworked and published as AfPs 2019:01 PAK containing only 15 of the PAHs proposed in this restriction (i.e. all 18 indicator PAHs except acenaphthylene, acenaphthene and fluorene).

Forum is also promoting a method (including sample preparation) developed by Austria based on AfPs 2014:01 PAK for their national restriction of PAHs in clay targets covering 16 PAHs[26] (i.e. all 18 indicator PAHs except benzo[*e*]pyrene and benzo[*j*]fluoranthene). The limit value for the sum of these 16 PAHs is 10 mg/kg. According to the laboratory in this Member State, the detection limit (LOD) for the sum of the 16 PAHs is within the range of 0.1 to 0.4 mg/kg (dry mass) depending on the composition of the clay target.

Forum noted that the method originally developed for REACH Annex XVII entry 50 could also be applied to the matrix PAH-containing binder/ground limestone for all identified PAHs (i.e. 18 indicator PAHs and the 3 recently classified PAHs). Although the matrices are very different, GCMS[27] analysis is highly sensitive with LODs at 0.1-0.2 ng/ml for each of the PAH analytes and 0.05-0.2mg/kg (FDA studies). It is expected that this analysis would be relevant using these studies as a guide in lieu of a fully validated GCMS method for this specific matrix.

During a telephone call between the SEAC rapporteur and the project manager for the development of AfPs 2014:01 PAK and AfPs 2019:01 PAK in the Federal Institute of Materials

[26] Acenaphthene, acenaphthylene, anthracene, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*ghi*]perylene, benzo[*k*]fluorathene, chrysene, dibenz[*a,h*]anthracene, fluoranthene, fluorene, indeno[1,2,3-*cd*]pyrene, naphthalene, phenanthrene, pyrene.

[27] Gas chromatography with mass spectrometry.

Research and Testing (BAM) of 8 April 2022, the rapporteur asked whether a specific method for PAHs in clay targets for shooting is needed. BAM-1.7 "Organic Trace and Food Analysis" sees no need for new development on methodology/CRM for PAHs in binder material of clay targets. Hence, the method, including the CRM originally developed for REACH Annex XVII entry 50, could also be applied to the matrix PAH-containing binder/ground limestone. In the case of clay target powder, the binder will probably be completely dissolved in toluene, no purification step should be necessary. Limestone is a "good-natured" matrix, will absorb/retain almost nothing of the analyte and thus hardly falsify/disturb the chemical analysis.

For evaluating the practicability of the restriction proposal, SEAC does not expect any major problems with adapting AfPs 2014:01 PAK and AfPs 2019:01 PAK for this restriction proposal. The methods are well established and have been used since 2014. In practice, 500 mg of sample material is weighed in and 20 ml of toluene is added. For internal calibration, three different PAH deuterium standards[28] are added to the toluene before. These are PAH with exchanged hydrogen atoms (hydrogen-1) against hydrogen isotope deuterium (hydrogen-2). The sample material is extracted in toluene for one hour at 60 °C in an ultrasonic bath. After cooling down to room temperature, an aliquot (subsample) is taken from the extract. In the case of polymers (entry 50 e. g. plastic or rubber products), matrix problems may occur during the analysis. In this case, a column chromatographic purification step would also have to be carried out before the gas chromatographic analysis. Quantification is carried out on the gas chromatograph with mass-specific detector (GC-MSD) using the SIM method (SIM: single/selected ion monitoring). During SIM, the mass spectrometric detector only "looks" at specific, selected masses, namely precisely at the molecular masses typical for the respective PAHs. This form of measurement is much more sensitive than the typical MS scan over a large mass range. A normal single quadrupole mass spectrometer is used for SIM.

The limit values in the restriction proposal are clear and the reference to the LOD used in the national restriction in Austria is given in the Background Document. In the AfPs 2019:01 PAH guideline, the sum of the PAHs from individual contents > 0.2 mg/kg is established. For the analysis of PAHs in clay targets (planned sum value limit 0.005 mg/kg) a validation of the method seems appropriate. Since there is an existing entry in Annex XVII, banning PAHs in other solid matrices at a lower limit than proposed in this restriction, the Forum assumes that the limit value (0,005 %) is higher than the LOD. From the experience of enforcement activities in Austria, the Forum assumes that a limit value of 0,0001 % would be feasible but considers that it has to be verified by practical experimentation. It must be ensured that the limit of quantification of each individual PAH component can actually be achieved with the test method. An effective method is, for example, to increase the sample weight from the current 500 mg into the range of grams. Given the size of the clay targets, this should not be a problem later on. Besides increasing the sample weight, the toluene extract could also be concentrated. Another possibility would be a so-called "large volume injection" in the GC-MS measurement.

A comparison of the AfPs 2014:01 PAK and AfPs 2019:01 PAK methods shows only differences in the list of PAHs. While AfPs 2014:01 PAK still contains 18 PAHs, the version AfPs 2019:01 PAK has only 15 PAHs listed as analytes. According to BAM-1.7, the basis for the PAHs selection in these methods could presumably be a mix of the long-standing 16 EPA PAH list and the new 8 PAHs according to REACH Annex XVII entry 50 for consumer products (18 PAHs in the AfPs 2014:01 PAK, as in the Dossier Submitter's proposal). The reduction from

[28] at least three internal standards of deuterated PAHs will be added to the extraction agent toluene: Standard 1: Naphthalene-d8, Standard 2: Pyrene-d10 or Anthracene-d10 or Phenanthrene-d10 and Standard 3: Benzo[a]pyrene-d12 or Perylene-d12 or Triphenylbenzene. RAC identifies that calibration standards, as single substances or mixtures with the 18 indicators PAHs, are also available (e.g. JRC Certified reference materials catalogue, Wellington laboratories, standards for environmental testing and research 2021-3023).for the three newly classified PAHs i.e. dibenzo[a,i]pyrene, dibenzo[a,h]pyrene and dibenzo[a,l]pyrene.

18 to 15 is due to the omission of acenaphthene, acenaphthylene and fluorene. Toxicologically, the focus is more on the larger PAHs, so the smaller PAHs such as naphthalene, acenaphthylene, acenaphthene and fluorene are less relevant. In addition, the smaller PAHs such as naphthalene, acenaphthylene, acenaphthene and fluorene are more volatile, associated with higher measurement uncertainties. In addition, one of them (acenaphthylene or acenaphthene) does not show fluorescence, which somewhat impairs HPLC fluorescence analysis (no problem with GC-MS).

Based on BAM 1.7, SEAC estimates that the cost to develop a specific CRM based on ground clay targets would be about € 100,000-200,000. This is the experience from the production of the CRM for REACH Annex XVII entry 50 (here BAM-B001[29]). The development of such a CRM takes about 2-3 years. The costs are determined by the complexity of process steps: Processing the raw material, homogenizing the shredded material, five analyses of 18/15 PAHs, round robin tests with different analytical methods, one-year testing for storage stability, certification by an external body, packaging, deep-freeze storage until dispatch.

RAC and SEAC agrees with the Forum that from an enforcement point of view, it is preferred to set the restriction with a permanent number of PAHs and not consider a dynamic link with the CLP regulation (EC No 1272/2008), nor the Candidate List REACH regulation (EC No 1907/2006). Indeed, each time an update would be made also an update of the analytical method is required and, also if a sum of PAHs is used and the limit value of the sum is fixed, then the detection limits for the individual PAHs would constantly have to be lowered.

A restriction setting the list of 18 indicator PAHs proposed by the Dossier Submitter is considered practical as it aligns with the existing rules of the International Sports Shooting Federation (ISSF). It would also contribute to meet the objectives of the POP regulation for PAHs as it includes the 4 indicator compounds used for the purpose of emission inventories of PAHs (i.e. benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene and indeno[1,2,3-*cd*]pyrene).

3.3.4. Monitorability

Justification for the opinion of RAC and SEAC

Summary of proposal:

Monitorability of the restriction is performed by measuring the concentration of indicator PAHs in the clay targets. The Dossier Submitter considers that the restriction is monitorable (see section 2.4 of the Background Document) and that monitorability of all restriction options is identical, since they are all based on an 18 PAH-limit.

RAC and SEAC conclusion(s):

RAC and SEAC note that the Dossier Submitter proposes to monitor the results of the implementation of the restriction by measuring the concentration of the sum of the 18 indicator PAHs in clay targets.

RAC and SEAC consider the restriction monitorable in principle. Clay targets can easily be collected from manufacturers, retailers or shooting ranges and analysed.

[29] CRM BAM-B001 "Polycyclic aromatic hydrocarbons in rubber toy" is intended to be used for performance control and validation of analytical methods for the determination of PAH in rubber toys, for example for enforcement of REACH Annex XVII Entry 50. The reference material may also be applicable for other similar consumer products. BAM-B001 was produced and certified under the responsibility of Bundesanstalt für Materialforschung und -prüfung (BAM). In addition to the in-house study at BAM, two interlaboratory comparison studies were conducted to support and confirm the certification of BAM-B001.

Key elements underpinning the RAC and SEAC conclusion(s):

Monitorability of the restriction is performed by measuring the concentration of indicator PAHs in the clay targets and therefore relies on the availability of analytical methods. Analytical methods are discussed in Section **Error! Reference source not found.**. RAC and SEAC do not expect any major issue related to analysis of PAHs in clay targets.

As monitorability is about monitoring the results of the implementation of the restriction, i.e. effect in reducing risks, RAC notes that the lack of data on eco resins composition does not allow to confirm that measuring of the concentration of the 18 indicator PAHs in clay targets would reduce the potential risk related to these specific binders. Therefore, RAC recommends to identify and quantify the PAHs in eco resins by the time of entry into force of this restriction.

3.4. UNCERTAINTIES IN THE EVALUATION OF RAC AND SEAC

3.4.1. RAC

Summary of proposal:

Add summary of Dossier Submitter proposal from the Uncertainties section of the Annex XV restriction report.

RAC conclusion(s):

See RAC opinion.

Key elements underpinning the RAC conclusion(s):

See RAC opinion.

3.4.2. SEAC

Summary of proposal:

Given the assumptions made in the assessment of cost-effectiveness of restriction options, the Dossier Submitter identified the following main uncertainties:

1. **Regulatory uncertainties**: If authorisation is granted to one or several of the clay target manufacturers in Europe, each restriction option will also result in significant producer surplus effects. Furthermore, if a restriction is applied on the use of a binder, additional producer surplus impacts are expected.

2. **Impact of variations of releases/emissions** on C/E ratios of restriction options, consisting of two main sources of uncertainties:

   a) A fraction of the larger fragments of clay targets may be collected and disposed of, thus reducing the actual release. Specifically, a release rate which is less than 100% would decrease the effectiveness of restriction options. This would reduce the cost-effectiveness of the restriction options considered (i.e. a restriction option becomes more expensive per kg of emissions avoided).

   b) The release estimate based on 18 indicator PAHs may underestimate the risks from release of CTPHT and other binders to the environment if it is not capturing all PAHs in the binder matrix. If, for instance, the use of 18 indicator PAHs would underestimate the total PAH releases by 50%, the C/E-ratio would decrease by 50 %. In other words, restriction options become more cost-effective. According to the Dossier Submitter, the potential underestimation related to estimating releases based on 18 indicator

PAHs (and not more PAHs) cannot be quantified since the concentration of other PAHs in PAH-containing binders is mostly unknown. Although registration information shows that the binders can contain PAHs, quantification depends entirely on whether other PAHs (than the 18 indicators) were analysed and whether the data was reported. This analysis is not available in registrations of CTPHT, petroleum pitch, petroleum resin and other resins in a systematic and exhaustive way that would allow for a quantification. As a consequence, the proposed restriction is expected to lead to an overall reduction of releases of PAHs in general that is greater than the releases that have been quantified.

3. **The exact quantity/share of clay targets produced with different binders placed on the markets in the EU**: The quantities will have an impact on the total cost and total release estimates. The Dossier Submitter assumes that marginal abatement costs would remain unaffected.

4. **The exact identity of the binder materials**: The identity and the PAH-content of binder materials is subject to uncertainty. The uncertainty may have an impact on which alternative binder materials are allowed under each restriction option.

5. **Assumption of a zero price elasticity of demand for clay targets:** A higher price elasticity of demand would result in lower total costs of each restriction option.

6. **Variability of the retail price for different binders:** A small variance in the retail prices of binders will have a minimal impact on the eventual C/E-ratios and marginal abatement costs. The time-path of the cost difference between different binders can have a moderate impact on the eventual C/E-ratios and marginal abatement costs. However, the Dossier Submitter has no information that would hint at significant changes over time.

Uncertainty categories 1, 2, 3 and 6 were analysed through a quantitative sensitivity analysis. In addition, the Dossier Submitter provided a qualitative discussion of the impacts of the uncertainties in Categories 4 and 5.

SEAC conclusion(s):

SEAC generally agrees with the categorization of uncertainties, and with the list of uncertainties presented in Section 3 of the Dossier. Regarding the implications of uncertainties on the evaluation of restriction options, and the scope/conditions of the restriction, SEAC notes the following:

1. The assumed **regulatory uncertainty** regarding pending decisions on two applications for authorisation does no longer exist because the Commission decided on 16 March 2022 to not grant authorisations for the use of CTPHT as a binder in the manufacture of clay targets. Therefore, assumptions regarding the impacts of the restriction on producer surplus (losses) adopted by the Dossier Submitter can be considered to be sufficiently grounded. In addition to the regulatory uncertainties pointed out by the Dossier Submitter, SEAC notes that there is political uncertainty due to the current trade embargo with Russia[30]. This may impact the supply of binders for eco-friendly clay targets in Europe. In particular, Russia and the United Kingdom have been suppliers of about 30% of eco-friendly clay targets placed on the market in the EU. Since the exact shares of relevant binders (i.e., eco resin and natural resin) provided by the United Kingdom and Russia are not known, the impact of a potential loss of Russian supplies of such binders could not be evaluated by the Dossier

[30] According to the information currently available, EU sanctions include the import of wood from Russia into the EU, but not the import of resins, see EU sanctions against Russia explained - Consilium (europa.eu).

Submitter. Assuming that Russia accounts for a high share of the supply of binders for eco-friendly targets, the possible scarcity of such binders would be higher than initially assumed, especially in the short run (i.e. the year of the entry into force of the restriction). SEAC notes that Russian supplies could, at least partially, be replaced by imports from the United Kingdom, although the speed at and extent to which supplies from the United Kingdom could be increased are also uncertain. In the medium and long-term, SEAC considers an increase of supplies from countries other than Russia more likely. Taking political uncertainty into account, and assuming that that this uncertainty still exists when the restriction enters into force, SEAC considers it justified to maintain a transition period of one year, but proposes a lower PAH content for this period, i.e. 0.1% instead of 1%, which corresponds to banning CTPHT *and* petroleum pitch (RO2) already in year 1.

2. SEAC agrees with the Dossier Submitter's analysis of uncertainties regarding the **removal rate of clay targets, and the potential underestimation of (avoided) releases due to using 18 indicator PAHs**. Furthermore, SEAC notes that a possible over- or underestimation of the benefits of restriction options will apply in the same way to all restriction options considered. Thus, C/E ratios will change symmetrically, but the uncertainty will not affect the final list of cost-effective options (see Table 7, Figure 1, and Table 1 and 2 in the SEAC Box included in the Background Document).

3. SEAC agrees with the Dossier Submitter's evaluation that the **exact quantity and the share of clay targets produced with different binder materials placed on the market in the EU** is an important source of uncertainty since changes in both components impacts both costs and benefits, and C/E ratios of assessed restriction options. Moreover, in contrast to Point 2 discussed above, changes in the quantity of clay targets produced with different binder will likely change C/E ratios of assessed restriction options differently. This can possibly impact proportionality, and the ranking, of restriction options. However, in the view of SEAC the selection of quantities as determined in the Dossier is reasonable, also because it is backed-up by information provided by the ISSF..
4. SEAC supports the evaluation of uncertainties regarding the **exact identity of the binder materials**. Generally, other substances containing PAHs used for clay target production, which were not identified in this report, might exist. Therefore, substances considered for the impact assessment (in particular the assessment of effectiveness) should not be considered as an exhaustive list of substances to be restricted. In addition, the identity (identifiers and composition) of the known binders is also uncertain. This is particularly true for binders other than CTPHT and petroleum pitch. As a consequence, emissions avoided and the costs of restriction options could be over- or underestimated. SEAC agrees with the Dossier Submitter that this uncertainty is impossible to quantify in the absence of verifiable data and measurements. SEAC appreciates the Dossier Submitter's sensitivity analysis of C/E ratios under the assumption that PAH concentrations in clay targets are higher than the central values assumed for the impact assessment. Provided that cost estimates remain the same, this illustrates that higher PAH concentrations increase the cost-effectiveness of restriction options. Furthermore, it supports SEAC's view based on its own assessment that adopting stricter measures (i.e. RO2 or RO3) already in Year 1 is to be preferred compared to the combination initially proposed in the dossier ('RO1+RO3').

5. SEAC agrees with the Dossier Submitter that C/E ratios of restriction options are highly sensitive with regard to **variations in retail prices for alternative binders** and, therefore, costs. Assuming that production processes have already been established for most of the alternative binders, there can be arguments for assuming gradually decreasing marginal costs of binder production after the entering into force of the restriction. Decreasing marginal costs would cause the retail price for alternative binders and, consequently, the market price for clay targets, to decrease over time. Similarly, an increasing demand for binders with a low PAH concentration can cause the price difference between CTPHT and alternative binders to increase during the

assessment period. SEAC notes that the latter situation is subject to uncertainty about the availability of eco-friendly binder, in particular eco and natural resin. Considering that about 30% of clay targets supply in the EU is covered by imports, particularly from the United Kingdom and Russia, short-term shortages could eventually occur because of changing supply chains, e.g. the trade embargo with Russia (see also Section 3.3.2.4)[31]. Without further evidence, the severity and duration of such impacts cannot be predicted with sufficient reliability. In a worst-case scenario (i.e. severe scarcity of eco and natural resin during and beyond the first year of the assessment period), costs of banning CTPHT, petroleum pitch and petroleum resin (RO3) and costs of an exclusive use of natural resin (RO4) could increase significantly, causing the average and marginal C/E ratio of these measures to increase. However, in the view of SEAC, it should be considered that clay target producers have emphasized their ability to adapt to changing market conditions, as this has already been the case in the past (see footnote 25). SEAC therefore considers it plausible that, even under worst-case conditions, the market for binder could adapt in the medium term, either by upscaling the EU production of eco and natural resin, or by expanding imports from the United Kingdom or other countries outside the EU. If there is evidence for significant shortages of binders for eco-friendly clay targets, SEAC considers a transition period of one year justifiable in order to allow a smooth transition to eco-friendly clay targets.

[31] According to the information currently available, EU sanctions include the import of wood from Russia into the EU, but not the import of resins, see EU sanctions against Russia explained - Consilium (europa.eu).

4. REFERENCES

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