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STUDY TO ANALYSE THE DEROGATION REQUEST ON THE USE OF HEAVY METALS IN PLASTIC CRATES AND PLASTIC PALLETS

Final Report

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1. INTRODUCTION

1.1. BACKGROUND

Packaging Directive

Packaging waste in the EU is a large and increasing concern: for example in 2002, on average 172 kg of packaging waste was generated per capita (EU-15). In 1992, the Commission proposed a Directive on Packaging and Packaging Waste. Following a prolonged discussion in the European Parliament and the Council of Ministers, Directive 94/62/EC was adopted.

The Packaging and Packaging waste Directive 94/62/EC and resulted Commission Decisions 1999/177/EC and 2001/171/EC contain provisions on the prevention of packaging waste, on the re-use of packaging and on the recovery and recycling of packaging waste. The (prolonged) implementation of the Directive in the new Member States is regulated by Directive 2005/20/EC.

Heavy metal limits in packaging

The packaging Directive aims to reduce the impact of packing and packing waste by limiting the total quantity that may be put on the market, by enhancing re-use and recycling and by setting limits to hazardous substances in the packaging. The Directive sets a maximum limit for the heavy metals in packaging: the sum of the concentrations of four heavy metals (lead, cadmium, mercury and hexavalent chromium) is not to exceed 600 ppm (as of July 1998); 250 ppm (July, 1999) and 100 ppm (July 2001). The Directive was amended by a series of secondary packaging legislation regulating i.e. the identification system for packaging materials, standardisation and reports of the Directives, the formats relating to the database system, and the conditions for derogation for plastic crates and plastic pallets, and glass packaging.

Derogation for plastic crates and pallets

The derogation for plastic crates and plastic pallets is the subject of this study which derives from the Decision 1999/177/EC stipulating that plastic crates and plastic pallets are allowed to exceed the above-mentioned heavy metal concentration levels established in the Packaging Directive, in case of compliance with all the conditions established in Articles 4 and 5 of this Decision. Articles 4 and 5 contain the requirements to manufacturing and recycling of plastic crates and pallets, notably requirement for closed-loop recycling.

The purpose of the Decision was to give time to the industry to reuse and recycle crates and pallets into new crates and pallets with a maximum added content of virgin material of 20%. However, in the Commission decision there were no provisions for withdrawal of the market of crates and pallets with heavy metals; therefore, all recycled products (with heavy metal content >100 ppm) put on the market in the last ten years were lawfully placed on the market.

The Commission decision is expiring on 4 March 2009. Industry has requested a prolongation.

1.2. OBJECTIVES OF THE STUDY

The Commission is confronted with different claims made by the industry in favour of a further derogation on the use of heavy metals in plastic crates and pallets and also opinions from some Member States. The main objective of the present study is to analyse the related issues in a structured manner and identify the information gaps and fill them in order to assist the Commission in evaluating this request.

1.3. APPROACH

In line with the terms of reference from the Commission, the data and information as set out by the Commission in light of request of the above cited derogation were analysed.

Literature study on the issue was carried out and some relevant publications were identified. To supplement this (limited) data from published sources, BIO was in direct contact with the industrial stakeholders – both the users as well as the recyclers of crates and pallets. For more research oriented questions (e.g. extraction of heavy metals from existing crates and pallets) technical experts were also contacted (see Section 4.1.).

2. CURRENT SITUATION

2.1. ISSUE

The derogation for 'plastic crates and plastic pallets' essentially refers and applies to plastic returnable transport packaging (RTP). They normally circulate in a system, which can be run by a single company (e.g. brewer), a group of companies (possibly via a joint venture), or a dedicated RTP pool company. Within the scope of the derogation and this study, the RTP can be divided in two main types, 'small' and 'large' RTP, which comprise of a number of different packaging for variety of applications:

RTP type	Plastic RTP	Applications
Small	**Crates**, boxes, trays, baskets	- Agriculture (fresh fruit & vegetables) - Supermarket (e.g. cheese) - Bakery - Beverage (beer, water, juice) - Dairy (milk, cream) - Pharmaceuticals - Automotive - Horticulture - Postal
Large	**Pallets**, box pallets, big boxes, display pallets, rolling displays, beverage trays, folding large containers	- Agriculture (shippers) - Beverage - Food processing - Pharmaceutical - Automotive

Unless further specified, in this study, the term 'crates and pallets' is used to refer to all the above-mentioned plastic RTP.

In the use phase, RTP may circulate between different parties, depending on the packaging type and system, for example:

<u>**Examples of some small RTP**</u>

- **Beverage (bottle) crates**: circulate between brewery ↔ distributor ↔ consumer

- **Agricultural crates**:
  circulate between the field/farm ↔ packing station (↔ distributor)

- **Super market crates/baskets**:
  circulate between packing station ↔ retail outlet/shop

<u>**Examples of some large RTP**</u>

- **Box pallets:**
  e.g. circulate between packing station ↔ retail outlet/shop

- **Pallets:**
  circulate in all parts of the distribution chain, except consumer

RTP can greatly reduce the amount of packaging waste generated. The plastic RTP provide for efficient storage and transportation of products, including fragile fresh agricultural produce or glass bottles. The plastic RTP have a long life cycle: the product life for a beverage crate, for example, is typically 10-15 years during which they can be reused more than 100 circulations. Due to the long product life the costs per circulation are very low and the raw material savings considerable compared to one-way packaging.

Further advantage of the returnable plastic packaging is that, at the end of the crate/pallet life cycle, the material can be mechanically recycled and used for the production of new crates and so is fed into a new life cycle. Re-use and recycling of the 4th generation crates and pallets is currently carried out. Consequently, crates / crate materials produced in the past decades are still largely in circulation. The crates produced from the 1960's up to about 1990 were made using heavy-metal-containing pigments in compliance with the regulations of the time. Due to the long life time and recycling of crates, the heavy metals are still present in these products today. (Brauer-Bund et al. 2008, EuPC 2008)

Beverage bottle crates are at the origin of the derogation on plastic crates and pallets, as the special situation of these products was highlighted by the beverage industry. They have also requested the prolongation of the derogation. Users of other plastic RTP in other applications for example in the food industry do not seem to consider this issue to be of relevance to them (CIAA, pers. comm.).

2.1.1. HEAVY METAL PIGMENTS IN CRATES AND PALLETS

The major polymers used to produce RTPs are polyolefins HDPE (high density polyethylene) and PP (polypropylene).

Of the four heavy metals limited by the Packaging Directive, mercury is normally not of concern in the plastic crates and pallets, while the three others (Cd, Pb and Cr[1]) can be found in concentrations >100 ppm.

Cadmium in crates and pallets originates from cadmium pigments, which refers to the pure sulphides and sulfoselenides as well as zinc-containing sulphides of cadmium. Cadmium sulfide (CdS) forms the basis for all Cd pigments. Cadmium pigments can be produced in a range of intense colours such as yellow, orange, red and maroon. (Buxbaum & Pfaff 2005.)

Lead and hexavalent chromium content in crates and pallets is above all due to lead chromate pigments. Lead chromate was used to achieve yellow colour; this could also be combined with blue pigments (e.g. iron blue) to obtain green pigments. For plastics manufacture these pigments were often stabilised by silicate, involving encasing pigment particles or crystals within a shell of silica. This was to protect the pigment from chemical, photo-chemical, and thermal degradation. (Buxbaum & Pfaff 2005.)

These heavy metal pigments were favoured as they, like almost all inorganic pigments, are extremely insoluble in normal conditions. Consequently, they do not readily leach out of e.g. plastics. They have excellent heat stability, light fastness and chemical resistance and have excellent non-migration and non-bleeding properties in polymers.

2.2. PROBLEM DIMENSION

2.2.1. TOTAL NUMBER AND TONNAGE OF PLASTIC CRATES AND PALLETS

According to the estimates provided by European Plastic Converters (EuPC) and European Plastic Recyclers (EuPR), the estimated plastic RTP pool (i.e. the RTP currently

[1] The Packaging Directive sets a limit for hexavalent chromium, Cr(VI), but when measuring concentrations in a coloured product, only total chromium content can be measured, which could be also due to other chromium compounds. Yet, knowledge on the pigments used in plastics allow estimating whether Cr(VI) was involved: Lead chromate pigments were used commonly in plastics. It constitutes of lead and Cr(VI). Thus, a significant lead content combined with chromium content hints strongly towards Cr(VI).

in use and circulation) consists of around 2000 million units (EU25, 2006). The total could be at least some 500 million units higher, considering the higher beverage crate estimate by that sector (see note after the following table).

Table 1 – Pool of plastic crates and pallets in EU25, 2006 (EuPC/EuPR 2008)

	Units (million)	Share of RPP Total
Retail RTP		
Beverage	830-950*	46%
Agricultural	300-400	18%
Supermarket	170-220	10%
Bakery	30-35	2%
Dairy	30-35	2%
Non-food retail	90-100	5%
Retail sub-total	***1450-1700***	***84%***
Industrial RTP		
Postal	100-110	5%
Horticultural	90-100	5%
Automotive	60	3%
Other industrial	60	3%
Industrial sub-total	***310-330***	***16%***
RTP TOTAL	1800-2000	100%

* The three main European beverage associations the Brewers of Europe, European federation of bottled water (EFBW) and Union of European Beverages Associations (UNESDA) have estimated that their members have 1.5 billion plastic crates in circulation.

Based on the data received from EuPC/EuPR, and assuming an average weight for small RTP to be 1.5 kg and for large RTP 15 kg, the tonnage of the current pool of plastic RTP can be roughly estimated at around 4.1 million tons. Of this total, small and large RTP comprise, respectively, 2.7 and 1.4 million tons.

The quantity of plastic crates in circulation varies greatly between Member States, depending on their market history. For example, in Germany the consumption of beer, mineral water, and fruit juices per capita is high and these products have been traditionally sold in glass bottles. Consequently, the stock of crates is big. On the contrary, in the UK for example, the beer for example is typically sold in cans which do not require crates. Thus the pool of crates in the UK is small compared to Germany.

In 2006, the demand for new RTPs was estimated at around 214 million units, which corresponds roughly to 10% of the European pool. This equals 636 000 tons of polymers. Recyclate (i.e. recycled material) covered 33% of this polymer consumption. Around 75% of the recyclate was HDPE and the remaining 25% PP. Overall, of the total of virgin and recyclate consumption, HDPE represented ca. 69% and PP 31%. (EuPC/EuPR 2008.)

According to EuPC/EuPC, plastic converters seek to use either up to 100% recyclate or 100% virgin polymer in the new products. Therefore, mixing recyclate and virgin polymers occurs in a minority of cases.

Major market development currently observed depend on the RTP type (EuPC, pers. comm., 2008):

- Beverage crates: market shrinking as glass bottles are losing market share to plastic (PET) bottles.
- Other retail crates: market growing as they are perceived as an ecological and economic option.
- Agricultural crates: market could be considered growing due to the reason given for ‘other retail crates’, however mechanisation may counteract this developments (these crates are used typically e.g. in hand picking). Thus, the market may finally remain rather stable.
- Pallets other large RTP: market growing as plastic pallets are increasingly replacing wooden pallets and other large RTP (e.g. big boxes) are perceived as ecological and economic packaging.

2.2.2. CRATES AND PALLETS CONTAINING HEAVY METALS

The purpose of the Decision allowing for the derogation was to give time to the industry to reuse and recycle crates into new crates with a maximum added content of virgin material of 20%. However, due to the long lifetime of the crates and pallets, natural recycling rate has been too slow to alter the heavy metal content in these products in the 10-year period. Especially for bottle crates, 10-15 year life time is common in active use. Due to changes in the beverage market, the rotation of the crates has slowed down in the past years; the slower i.e. less intensive use of crates means that they can last 30-40 years in use[2].

The percentage of crates containing heavy metals depends on the colours that were used in the crates from the 1960’s to early 90’s, as the high heavy metal content was characteristic especially for red, yellow and green crates. Furthermore, while in some countries (e.g. in Finland) practically all crates, especially in the past, belonged to a

[2] It should be noted that such a long life time is technically possible, but for marketing reasons creates (especially brand specific) are normally recycled/remanufactured in a shorter interval in order to realise new designs.

common system and thus are all the same, in many other countries many breweries had their own crates with different colours.

According to EuPC/EuPR (pers. comm. 2008), high heavy metal content is rather relevant for beverage and small agricultural crates/baskets which were already commonly used a couple of decades ago. Other RTP have been largely made in the last 15 years and were thus originally heavy metal free (although exemptions are likely to exist).

Table 2 presents the available estimates regarding the quantity and/or percentage of crates (and pallets) that contain heavy metals above 100 ppm.

Table 2 – Estimated quantities of crates (and pallets) containing heavy metals

Market	Total pool of crates/pallets (million units)	Pool with HM > 100 ppm		Source
		(million units)	(% of total)	
Austria**	-	-	50-60%	AT 2008
Belgium*	7	2	30%	Confederation of Belgian Brewers
Germany*	500	300	60%	Brauer-Bund et al. 2008
Spain*		>> 3.7 ***		
EU*	1500	500	33%	Brewers of Europe/EFBW/ UNESDA
EU**	-	-	≤60%	EuPC/EuPR (pers. comm.); EuPC/EuPC 2008

* estimation for beverage crates only
** estimates for all plastic crates and pallets
*** the total is likely to be much higher, as this figure corresponds to only one beverage producers

Based on the available data, around 30% of the beverage crates at the EU level would seem to contain heavy metals above the 100 ppm concentration. For other plastic RTP, the data is less robust. The percentage could be as high as 60% as suggested by EuPC/ EuPR. However, this estimate seems high in comparison with the percentage of bottle crates, which are assumed to be at the heart of the heavy metal issue.

For individual companies or bottle crate systems, the percentage can be very high, reflecting the use of the same heavy metal pigment in the whole crate pool. A leading soft drink company in one of the large member states has reported that 84% of its bottle crates currently in circulation contain heavy metals above the 100 ppm limit.

Applying the 60% estimate to the total tonnage of the RTP stock of 4.1 million tons, suggests that there can be 2.5 million tons of heavy metal containing RTP in the European market.

Trends

It is impossible to provide an estimate of the current "typical heavy metal content" in plastic crates and pallets containing them, since even the original concentrations were diverse. According to the plastic converters, the levels may still vary between 500 - 2000 ppm. They estimate that most plastic crates and pallets containing heavy metals have still levels of around 1000 ppm (EuPC/EuPC 2008 and pers. comm.).

Mennen et al. (2002) report secondary measurement data from 1997 based on a sample of 25 crates: Cd concentration varied between 1 - 1700 ppm, Pb was 1 - 4000 ppm, Cr 1 - 3000 ppm, while Hg was very low (<5 ppm in all samples). A study about heavy metals in packaging on the Belgian market (De Brucker et al. 2001) analysed 15 different beverage crates with various colours (green, red, orange and brown[3]) as well as 7 different pallets (black and brown). The results (Table 3) show the heterogeneity of the heavy metal content and also confirm the statement made previously that mercury is normally not an issue in plastic crates.

The heavy metal content is decreasing gradually but slowly, since a crate lives typically for 10-15 years, after which it is recycled adding ≤20% of virgin material. Thus the dilution effect is small. Considering that many plastic crates still have heavy metal content of 10 times higher than the current limit value, the plastic material would have to be recycled around 10 times (each time adding 20% of virgin) before the limit value would be achieved. Considering a typical lifetime of 15 years, this could take 150 years in the business-as-usual case.

Table 3 – Summary of the analysis of plastic crates and pallets in the Belgian market (De Brucker et al. 2001)

	Presence of heavy metals	
	in Beverage crates (sample size: 15)	**in Pallets (sample size: 7)**
Cd	Found in 4 samples in levels 200 – 1300 ppm (all red crates, produced prior to 1979)	Found in all samples at levels above 100 ppm
Pb	Found in 4 samples at levels above 100 ppm	Found in 1 sample at a level of 1400 ppm (brown); in other samples the level was <100 ppm
Cr	Found in 6 samples at levels above 100 ppm – some could be Cr(VI)	Found in 5 samples at levels 100 – 400 ppm – some could be Cr(VI)
Hg	Below limit of detection in all samples	Found in 1 sample at very low level of 1.8 ppm; below detection limit in others

[3] It should be noted that all these colours are known to be associated with heavy metal pigments.

2.3. IMPACTS OF HEAVY METALS IN CRATES AND PALLETS

2.3.1. USE PHASE

Heavy metals in plastics, notably cadmium, have been highlighted as a concern especially in applications like children's' toys. These products risk to be chewed by children being thus exposed to (repeated and extended) contact with saliva. Furthermore, any heavy metal thus leached would be ingested by the child.

Skin contact

The situation is different in case of plastic crates and pallets. Small RTP are in contact with the human skin (hands) only momentarily when they are being lifted and carried by the user. Pallets and other large RTP are rather moved around and stocked using forklifts due to their size and weight and they are hardly in contact with the skin.

The only known results of testing regarding the potential health impact due to the handling of heavy metal containing crates indicate that there seems to be no health risk to humans handling the crates (Box 1). As analysed by Institut NEHRING, the heavy metal traces of 0.8 and 0.9 ppb (Pb + Cd) are well below the European requirements for water intended for human consumption (Table 4**Erreur ! Source du renvoi introuvable.**).

Table 4 – Minimum quality requirements of water intended for human consumption according to the Drinking Water Directive[4]

Substance	Maximum concentration [µg/l] = [ppb]
Cadmium (Cd)	5.0
Lead (Pb)	10

These results support the claim of the plastic converters and beverage sector that "the heavy metals contained in the crate and/or pallet are encapsulated in the plastic matrix and that there is no migration[5]. The use of these recyclates does not raise any health or safety issue neither for workers nor for consumers".

The experts in the OECD Workshop on Lead products and uses (OECD 1994) were of the opinion that "for the uses of lead pigments in plastics, the potential for human exposure is minimal because the lead content is locked in a stabilizing matrix creating a situation of very low availability. It follows that the health risks from plastic products and their use is negligible." Murphy (2001) also states that in use "under normal

[4] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, Annex I, Part B

[5] The term migration refers to the occurrence of dissolved portions of pigment migrating from their medium of application to the surface or into a similar material that their system is in contact with.

circumstances, additives [e.g. pigments] locked in by efficient [plastic] compounding should not escape."

Box 1 – Test regarding the potential health impacts of heavy metals in plastic crates

In order to provide scientific evidence of the potential health impacts of heavy metals in the plastic crates, GDB[6] commissioned Institut NEHRING[7] to execute tests, in order to establish, if and to what extend heavy metals migrate from crates containing more than 100 ppm of heavy metals (due to the decision 1999/177/EC) during their handling, and, thus, may pose a health risk to the consumers.

Two crates were tested, both with a heavy metal content >500 ppm:

1) Crate in its first life cycle. Heavy metals content: 240 ppm Pb + 270 ppm Cd.

2) Crate produced from recycled material. Heavy metal content: 150 ppm Pb + 410 ppm Cd.

The contact with the human skin was simulated by standardised human sweat simulant (DIN 53160[8]), into which a part of the crate was submerged during 24 hours at 40 °C. After that the simulants were analysed for Pb and Cd. Only traces could be established: 0.6 ppb Pb + 0.2 ppb Cd, and 0.4 ppb Pb + 0.5 ppb Cd, respectively, in Crate (1) and Crate (2)[9]. Both results referred to a contact surface of 1 square decimetre, i.e. 10 cm × 10 cm.

The summary given by Institut NEHRING concludes: "A health risk from lead and cadmium caused by a normal handling of mineral water crates by the consumer can – to our opinion – be excluded, according to the results of our tests."

See Annex 1 for the copy of the test reports.

(VDM, pers. comm., 2008)

6 GDB - Genossenschaft Deutscher Brunnen is a co-operative which administers the uniform packaging pool (crates and bottles) used by nearly all of the about 220 German producers of natural mineral water

7 Institut NEHRING is a German laboratory specialised in research on foodstuff, packaging and environment.

8 The human sweat simulant according to DIN 53160, is an acid solution with a pH of 2.5. In 1000 ml of distilled water it contains: 4.5 g NaCl, 0.3 g KCl, 0.2 g Na_2SO_4, 0.4 g NH_4Cl, 3.0 g CH_3^- CH(OH)-COOH, 90 %, 0.2 g H_2N-CO-NH_2.

9 ppb, parts per billion - for example, 0.6 ppb = 0.0006 mg/l = 0.6 µg/l.

Only in very few applications (e.g. of those in Table 1) the RTP is in direct contact with food products, most significant being agricultural and bakery small RTP and some large agricultural RTP (e.g. big boxes). Other food retail RTP are in contact only with the packaging of the food products, prime example being bottles.

Food contact

The direct contact of RTP with food products is associated with fresh products, which by their nature are stored for limited periods and consequently the contact times are relatively short. No published evidence was found of the health risks related to contact of fresh food products with the plastic crates containing heavy metals. The testing described in Box 1 was carried out to stimulate the impact of the direct skin contact, but the conclusions can be regarded as valid for the contact with food products as well, considering that the fresh products do not come even close the rather aggressive conditions of the sweat simulant with its pH of 2.5.

European Environmental Bureau, EEB (pers. comm.), also thinks that the contact with food is not an issue.

2.3.2. RECYCLING / PRODUCTION

Most of the plastic converters (i.e. those who manufacturer crates and pallets) have their own plastic recycling unit consisting of granulation, possibly combined with washing/cleaning of granulates. Granulation is carried out by mechanical crushing. This generates dust. When the crushing is combined to washing, the dust is taken up by the water of which it is eventually separated. When heavy metal containing crates are treated "responsibly", the dust and other impurities removed in the cleaning step (including sand, etiquettes, etc.) are disposed of as hazardous waste. Also, the water used for washing is disposed of as hazardous waste. According to a plastic converter this is done as a precautionary measure, as in practice migration of heave metals to the washing water has not been observed (Mr. Merkx, pers. comm.).

If the above-mentioned principles are respected, as should be in the case of proper recycling process, no specific concerns or harmful impacts have been identified. The quantities of impurities generated and disposed off as hazardous waste are very limited.

The production of new crates and pallets from recyclate involves melting and injection moulding of the plastic. In the process, some virgin material may be added to keep the plastic quality. Furthermore, additional (non heavy metal) colour can be added. To guarantee the durability and light-fastness of the crate and its colour, UV-protector is added to the recyclate in manufacture. No heavy metals or other hazardous substances are released under the conditions of the production process, since heavy metals/heavy metal pigments do not volatilise in the temperatures used.

2.3.3. Implementing the closed and controlled loop

As defined in the Article 1 of the Decision 1999/177/EC, the derogation applies to "plastic crates and plastic pallets used in product loops which are in a closed and controlled chain". Article 2 further defines that " 'product loops which are in a closed and controlled chain' shall mean product loops in which products circulate with a controlled reuse and distribution system and in which the recycled material originates only from these entities in the chain ...".

In beverage sector, crates may either be the property of the beverage producer/brewer or they may belong to a bottle&crate system common to different beverage producers (the common system may be a joint venture of the producers or an independent company). Regardless of the system, in many main "crate countries" the consumer or the client (e.g. a restaurant) pays also for the bottles and crates, and he only receives a refund when returning them to the distributor. This has proven to be an effective method of encouraging the return of both the bottles and crates and, according to the beverage industry, the bottle and crate losses in these systems are negligible.

Crates and pallets are the property of the product producer (e.g. a brewer) or the company managing the crate/pallet pool system. Hence, they are part of company assets and thus it is in the interest of the company to get them back. Furthermore, besides their transport function, especially bottle crates have gained increasing importance as a marketing tool in the last few years, as the crate reinforces the brand image. This also encourages companies to recover their old crates and recycle them, rather than leaving them "out there" to be potentially used by others. (Mr Merkx, pers. comm.)

While the heavy metal containing crates and pallets are part of a company's assets, they are also a "burden" which companies concerned bear as historical responsibility. New companies or RTP systems do not want to have crates and pallets marked as containing heavy metals. For new systems, there is no incentive to choose for heavy metal containing crates since the price is roughly the same as for heavy metal free crates. This means that there are no external markets for the heavy metal containing recyclate and thus such crates stay in the hands of their original owners and in closed loop.

In Germany, where most of the crates containing heavy metals are in use, the market participants (producers and users of plastic crates and pallets) voluntarily developed a documentation system fulfilling the requirements (also provided in §13 and appendix II of the German packaging regulations). In detail, this means that:

1) All crates and pallets are tagged with regard to their material type and heavy metal concentration.

2) Manufacturers of crates and pallets provide declarations of conformity and an annual report stating mass flow for heavy metal containing crates, pallets and recycled material.

3) A stock registration and control system was created which guarantees a verification of the return quota via data collection. Every year, the associations of the beverage industry have an independent expert executing a survey on the bottle crate return quota.

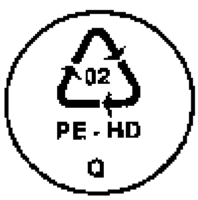
4) All bottle crates and pallets returned and not used again are submitted to a recycling procedure in compliance with the Packaging Directive conditions: The German manufacturers of plastic crates and pallets are syndicated in the association Pro-K, which has developed basic rules for the qualification to process recycling materials containing heavy metals. (Brauer-Bund et al. 2008.)

The parties of the German systems agreed on three separate forms with which the stock changes can be followed up on the one hand, and which on the other hand include the necessary statements, i.e. conformity to requirements regarding production conditions and adoption exclusively for use in a stock-controlled reusable system. Annex 2 present the form of 'Declaration of transfer by the user' where the material transferred from the user (e.g. brewery) to manufacturer (i.e. the plastic converter) is documented and confirmed. The form consists of 3 copies, one for each party of the transfer and third copy to be sent to the central entity responsible for stock taking.

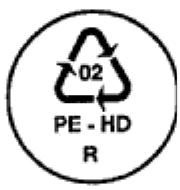
In order to be able to identify packaging that has been manufactured under utilisation of the derogation, it has to be visibly and durably labelled. But the Decision did not determine the designation of the symbol to be used. Following the German initiative, manufacturers of plastic reusable packaging have agreed to expand the material labelling by adding an underline bar to indicate manufacturing under utilisation of the derogation (Brauer-Bund et al. 2008.):

Plastic packaging made of heavy metal containing recyclate (> 100 ppm) – market with the line under the plastic type.

In comparison, heavy metal free plastic packaging is labelled as:



Made of virgin polymer



Made of recyclate, virgin polymer possibly added

According to EuPC/EuPR this labelling system has been commonly taken up Europe wide, but at least one important beverage manufacturer has indicated that, instead of the “harmonised label”, their own crates containing >100 ppm heavy metals are internally identified by the production date which is engraved on the product. (Confidential pers. comm.) This manufacturer has a recycling system in place for its own crates, integrated in a close loop for the permanent use of the crates. The system works through their bottlers, the hotel-restaurant-catering (HORECA) customers and the distribution system of the company.

Environmental benefits of controlled recycling

As has been explained above, for the controlled recycling using appropriate technology, no specific concerns or direct harmful impacts have been identified. In this context the recycling of existing crates and pallets can be considered beneficial. The recycling guarantees an optimal use of resources by turning old crates into new packaging. If all crates were to be replaced, a lot of virgin material would be needed[10]. Also, the disposal of heavy metal containing material from crates and pallets is avoided: the same plastic material can go through at least 4 “crate lives”, i.e. serving for 40 years or more. After this the recyclate can still be used to produce pallets which have somewhat lower requirements for the plastic quality. The pallets can again be recycled a number of times. Hence, the same batch of crate/pallet plastic can be used over a period of 100 years. The multiple uses of the raw materials contribute to the preservation of resources to a high degree, saving oil resources.

Recycling is also less energy intensive process than the oil extraction and production of virgin resins. It therefore contributes to the avoidance of CO_2 emissions. It has been estimated that using recyclate plastics instead of virgin plastics generates 30% less CO_2 emissions (EuPC/EuPR 2008).

As will be explained more in detail in Section 2.5. , the industry considers that most of the companies using reusable crates would face serious difficulties in coping with the economic burden due to eventual non-prolongation. Even if they could cover the cost of disposal of old crates, they would likely not have the resources to invest in new reusable crates at one go and would be likely to switch to one-way packaging. (Brauer-Bund et al. 2008.) Such shift could lead to increase in packaging waste.

[10] Unless viable technology is implemented and available in a sufficient scale to remove heavy metals from the plastic material (see Section 2.4.1.).

2.4. END-OF-LIFE ISSUES

2.4.1. POSSIBILITIES AND TECHNOLOGIES FOR EXTRACTING THE HEAVY METALS FROM CRATES AND PALLETS

Chemical recycling processes

In principle, the heavy metals can be extracted from the crate and pallet plastic via chemical recycling[11]. At least two processes have been independently developed in the Netherlands to extract cadmium (pigments) from HDPE plastic matrix:

- A process developed by TNO in cooperation with Heineken, based on dissolving of the pigment with an organic solvent (xylene) (van der Steen and van Oeveren 1993)
- A process developed (and also originally patented in 2003) by the Eindhoven University of Technology, based on the conversion of cadmium pigment (CdS) into $CdCl_2$ by treatment with HCl, followed by extraction of $CdCl_2$ with organic solvent (1,4-butanediol) (Waanrooij et al. 2006). The process invention relates in particular to cadmium sulphide, but it is not limited thereto. The process is applicable to heavy metals from different groups, in particular Cd, Zr, Zn, Hg, and Pb (WIPO 2003).

Both processes allow the recovery and reuse of the plastic (HDPE) matrix. But the extracted cadmium pigments/compounds will in both cases have to be disposed off to special landfills reserved for such waste.

The “Eindhoven process” has never been applied beyond the laboratory scale, while the “TNO process” was taken up by Sea Way Refining BV (see Box 2), who carried out processing at industrial scale for almost a year before a fire in the production unit and the consequent bankruptcy of the company brought an end to the activity (Haarlemsch Dagblad 2005; Knip 2003; Kutterink 2007).

All the contacted stakeholders have confirmed that, following the closing down of the Sea Way installation, there are currently no processes for Cd/heavy metal extraction that are proven technology, have field scale experience, and have an existing, ready available capacity (pers. comm. with Mr. Jansen, Mr. Van Kasteren and EuPC/EuPR among others). According to beverage industry, two further plants in Europe, one in Italy and the other one in Denmark, developed a technology aiming at the removal of heavy metals from old plastics, but according to them this led to very poor results. No further details could be obtained on these two plants and their processes.

[11] Chemical recycling involves the transformation of plastics, i.e. plastic polymers, by means of heat and/or chemical agents to yield monomers or other hydrocarbon products that may be used to produce new polymers, refined chemicals or fuels. Mechanical recycling refers to processing of waste plastics by physical means (grinding, shredding, and melting) back to plastic products.

Stakeholders consider that such a process, if ever technically feasible, is unlikely to be able to operate under reasonable economic conditions (e.g. Brauer-Bund et al. 2008). According to the business plan of Sea Way, operation was calculated to be economically feasible if the heavy metal containing plastics were received for free i.e. the revenue from the sales of the cleaned recyclate was considered to cover the operating costs. This business model was based on the idea that companies would be happy to give away heavy metal containing crates and pallets to avoid disposal costs. This is of course not the case under current and possibly future extended derogation.

A number of stakeholders have highlighted that in the current situation there is no incentives or need, and hence no interest to invest in the further development of methods/operational processes.

Box 2 – Sea Way Refining BV (SWR)

SWR was established for the processing of plastic wastes on an industrial scale, and specifically polyolefins, into a high quality raw material for the plastic converting industry.

In 2003, a pilot plant to test different processes and process operations was successfully commissioned. In 2004, an existing plant was converted to a plant for the recovery of pure polyethylene from used and contaminated polyethylene. The plant was commissioned in the 3rd quarter of 2004 and became operational in January 2005.

The first batch of polyolefins which was processed was granulated material from crates in which cadmium was used. Heineken and Sea Way signed an agreement for the processing of 28 000 tons of granulate in total from the well-known yellow and red crates of the brewer. Granulate which consisted of polyethylene (HDPE), was processed by dissolving it in an organic solvent. The cadmium was then separated by filtration and the HDPE recovered from the solvent. This HDPE had practically the same quality as the original virgin HDPE and could be used again as a raw material.

(http://www.sea-way.nl/; Knoppers2003)

Fate of extracted heavy metals

Even if the extraction technology would become available, it would yield hazardous waste (heavy metals) as a by-product. Since heavy metals are being phased out of many applications, there is no further use or markets for these metals. Hence, final disposal remains the only option. Extracted heavy metals are likely to be more mobile than heavy metal pigments in plastics and the risk of migration in landfills is higher. The extracted heavy metals are thus destined to special hazardous waste landfills. (EuPC 2008)

2.4.2. Disposal of crates and pallets containing heavy metals

As explained in the previous section, at present there is no system in operation to extract the heavy metals from the crates and pallets while conserving the plastic matrix at the same time. Mechanical recycling is currently the only alternative to recycle this packaging. Hence, if the derogation is not extended and the crates and pallets are to be removed from the market, they have to be disposed off either by landfilling or incineration. Without the derogation, Germany alone would have to dispose of about 1 million tons of plastics (Brauer-Bund et al. 2008). At the European scale, the figure has been estimated at around 2.5 million tons.

The key question then is to what extent the landfilled/incinerated heavy metals will be mobilised and released to the environment.

According to many stakeholders, in both the case of landfilling and incineration, crates and pallets would have to be treated as hazardous waste due to the heavy metal content (Brauer-Bund et al. 2008, Orangina Group, pers. comm.). However, others have pointed out that crates containing heavy metal pigments are not necessarily dangerous waste according to Directive 91/689/EEC. Based on the existing EU legislation, crates containing <1000 ppm heavy metals would seem not be considered hazardous waste according to Article 2 of the Commission Decision 2000/532/EC.

Box 3 – Classification of waste as hazardous

Plastic crates and pallets do not directly fit any of the categories of hazardous waste listed in Annex of the Commission Decision 2000/532/EC. The category "15 01 08 - Packaging containing residues of or contaminated by dangerous substances" could perhaps apply. However, according to the Decision, even if a waste is identified as hazardous by a specific or general reference to dangerous substances, the waste is hazardous only if the concentrations of those substances are such (i.e. percentage by weight) that the waste presents one or more of the properties listed.

The list, provided in Article 2 of the Decision, has been looked at and regarding plastic crates and pallets, the most restricting condition applicable would seem to be the following (Cd being classified as Carcinogenic – category 2):

One or more substances known to be carcinogenic of category 1 or 2 at a total concentration ≥ 0.1%.

Consequently, plastic crates and pallets with a cadmium content of ≥ 1000 ppm could be considered hazardous waste, while crates with < 1000 ppm cadmium would not be considered hazardous waste.

If treated as a hazardous waste, both landfilling and incineration processes are such as to contain heavy metals and thus avoid any harmful impacts to health or environment.

If crates and pallets are not treated as hazardous waste there is a varying risk of heavy metal emissions to air, soil and/or water.

- **Landfill**

As previously explained, heavy metal pigments are known as extremely insoluble. Thus they are claimed not to leach to the environment, for example from landfills.

Among others, Murphy (2001) states that "in landfilling, pigments in plastics will not dissociate and are insoluble in water".

A report of the Nordic Council of Ministers (2003) admits that "the mobility of cadmium inside landfills is low, and a complete wash-out of cadmium may require hundreds to thousands of years and in some cases even more" but it also mentions that "no evidence exist that landfills can be regarded as a permanent containment of cadmium".

In reality, the stability of the heavy metals seems to depend on the integrity of the crate/pallet. At least a case is documented, were stocking CdS coloured HDPE recyclate granulates outside in open air during 5-6 years resulted in elevated cadmium concentrations in the soil and surrounding water courses (confidential pers. comm.). Indeed, Patton (1973) states that cadmium sulphide yellow pigments have excellent resistance - except in the presence of moisture - and may thus suffer from poor outside weatherability. According to Buxbaum and Pfaff (1998), cadmium pigments are lightfast but, like all sulphide pigments, can slowly be oxidised to soluble sulphates by UV light, air and water. This photo-oxidation is said to be more pronounced in cadmium yellow than cadmium red.

Chrome yellows and oranges are relatively resistant in alkaline conditions but are subject to attack by acids (Patton 1973), which could make these pigments vulnerable to acid rain.

So, it seems that heavy metal pigments may be degraded for example in landfill. However, as Buxbaum and Pfaff add, the resistance to light and weather depends on the pigment, but also on the medium in which the pigment is used. While leaching from whole crates and pallets is extremely low, over an extended period of time heavy metals may be leached from granulated material which has a large surface area-to-volume ratio, especially in (industrial) areas where the rain water is acid. If plastic crates and pallets are to be landfilled they will most certainly be chipped/granulated prior disposal to reduce the volume. This would make the heavy metals more vulnerable for leaching.

- **Incineration / pyrolysis**

If the plastic material is not reused, incineration would at least enable to recover the energy content of the plastic. It can thus seem to be more beneficial than landfilling.

However, the incinerator must be equipped with adequate filters to cope with heavy metals. Modern incinerators should have sufficient abatement systems while older installations may lead to heavy metal emissions to air.

European Environmental Bureau has highlighted that when waste crates and pallets are incinerated, the heavy metals can spread to environment as air emission in bad performing incinerators. According to EEB, only Hg is measured continuously in some plants, all other heavy metals are subject to very few spot measurements and thus adequate emission abatement may not be guaranteed. It is also common to incinerate plastic waste in co-incineration plants (presently mainly cement plants), which at present may not use appropriate abatement techniques according to EEB. The Hg emissions are continuously measured only in few cases; all other heavy metals are measured with spot measurement. (EEB, pers. comm.)

Even if the direct air emissions are avoided, the heavy metals end up in fly and bottom ashes, which need to be treated accordingly, i.e. as hazardous waste. This may not be the case if crates themselves are not considered hazardous waste.

Apart from depositing the ashes from incinerators, they are partly re-used, mainly as underground material for streets, especially when not identified as hazardous. The ashes of co-incineration plants may be used in products (mainly mixed into cements). During cement corrosion and destruction/recovery of building, heavy metals are released as particles to the environment. (EEB, pers. comm.)

At present, there is no viable process to further extract heavy metals from the ashes, for example for reuse in other (authorised) applications. In other context, such technologies are under development (e.g. Ashdec process in Switzerland, http://www.ashdec.com) but as heavy metals are increasingly being phased out from different applications, reuse opportunities will be scarce and finally heavy metals will still need to be disposed off in landfills.

In principle, the classic NiCd battery pyrometallurgical recycling processes could be used to pyrolyse the plastic fraction (possibly recovering energy) and recover the cadmium. But, as pointed out by Mr Jansen (pers. comm.), battery recycler have no interest in processing old crates to recover cadmium as there is very little demand for this metal due to the use restrictions. Some market remains in China where cadmium is still used to manufacture NiCd batteries, but even this use is likely to end in the near future. Without market, the recovered heavy metal would again be destined to hazardous landfill.

It is generally acknowledged that heavy metals liberated from the plastic matrix by incineration are more mobile and likely to leach and spread to the environment than when captured in the plastic matrix.

Due to the air emission abatement requirements and the ash issue the incineration of crate is also expensive (Mr Jansen, pers. comm.).

2.4.3. OTHER POSSIBLE USES FOR THE PLASTIC FROM CRATES AND PALLETS

In addition to recycling back to crates/pallets, this packaging can, from the technical point of view, be used in a variety of other applications. However, Cadmium Directive (83/513/EEC) sets limits in many products, so from the legislative point of view such uses are limited.

2.5. ECONOMIC ISSUES

The users and owners of plastic crates and pallets are a very heterogeneous group including large multinationals and very small enterprises. Thus the overall economic impacts cannot be easily quantified. Big companies would be likely to be able to bear the costs of any option, but especially in the beverage sector which would be the most affected by the non-prolongation, the share of SMEs is high. So, special attention here is paid to the SMEs: a German example illustrates possible economic impacts (Box 4).

The exact structure of the beverage sector varies significantly across Member States, but in many of them the share of SMEs is high, as illustrated by the available data:

- In Belgium, 65 breweries are members of the Belgian Brewers' association. Of these 57 (88%) are SME. Within the SME, 74% of the companies, i.e. 42 breweries, are affected by the derogation.

  Belgian Federation for waters and soft drinks (FIEB) has estimated that four SME are concerned by the derogation; they represent 22% of the membership.

- In Denmark, Danish Brewers' association has 98 members, 85% of which are "micro-breweries" (having less than 10 employees). 12 companies are estimated to be affected by the derogation: 5 micro-breweries, 5 small breweries and 2 medium breweries.

- In Germany, currently there are some 1 302 breweries. Approximately 96% of them are SME according to EU definition. About 7/8 of all German breweries are small and micro enterprises. (Deutscher Brauer-Bund e.V., pers. comm.)

  In German soft drinks industry the 96 % of the companies are classified as SME (wafg, pers. comm.)

- Of the 411 German fruit juice producers, 95%, i.e. 392 are SME according to the definition of the European Commission. A vast number of the companies are small respectively very small enterprises employing less than 50 respectively 10 employees; in total, they are assumed to represent 92 % of the companies.

  Of the 392 SME, 320 (82%) use the reusable package system of the Association of the German Fruit Juice Industry (VdF). Due to their original colour, VdF crates contain pigments of heavy metal.

Of all the German producers, 194 (large) companies are direct members of the VdF. 197 smaller companies are members of regional associations of the VdF and 20 very small enterprises are not members of VdF. The 197 "small" member companies of the regional associations and the further 20 very small enterprises register an annual turnover of 2.6 million Euros at the maximum. (VdF 2008; VdF pers. comm.)

Box 4 – Example of economic impacts of non-extension of the derogation – German mineral water industry

"Median" company (no.80 of 160 in VDM's listed ranked by size) produces 34 billion bottles of beverages per year: ca. 75% mineral water and 25% mineral water based soft-drinks. This translates to ca. 2.8 million crates filled per year (12 bottles per crate). Assuming that a crate does 6 trips in a year, 470 000 crates are needed and thus make up the crate pool of this manufacturer. Applying the German heavy metal percentage of 60% (see Section 2.2.2.), this company would have 280 000 million crates with >100 ppm heavy metals and thus concerned by the derogation.

If there is no extension for the derogation this company will have purchase new crates as well as pay for the disposal of their old crates as hazardous waste.

a) Purchase of new crates (à 4.20€) = 1.2 million €

b) Cost of disposal as hazardous waste (weight of a crate for 12 bottles ca. 1.7 kg; price of hazardous waste disposal ca. 3 €/kg) = 1.4 million €

Hence, the total costs would amount to 2.6 million Euros. Comparing this to the typical profit of such a company, it can be seen that it is impossible for the company to cover such costs from its running revenues: it would take the gross profit of more than 5 years to cover the costs.

Furthermore, the calculation is likely to be a conservative estimation, since the heavy metal quota for the uniform crate pool of the mineral water industry is supposed to be above 60%, and the price for new crates is meanwhile above 4.50€ due to increasing raw material prices. Increasing demand for new crates in case of non-extension would probably lead to further increase in crate prices.

(VDM, pers. comm.)

The Belgian Brewers' association has estimated that a smaller traditional brewer would incur cost of about 900 000 € if he has to replace his crate pool by new crates. In addition, he would have to bear the expenses for disposing of the old crates. (Brasseurs belges, pers. comm.)

The German Brewing Industry is relying heavily on returnable bottles (approx. 90%), applicable for large and small enterprises likewise. Majority of returnable bottles is sold in crates. Each brewery (large and small) owns about 2.5 crates per hectolitre. The 500 million crates in use by beverage industry in Germany represent, alone, a total value of about € 2.5 billion. It has been estimated that non-prolongation of the derogation would result in a value loss of currently € 1.5 billion and the disposal costs for the affected plastics would amount to another € 1.8 billion, approximately. According to the German beverage industry, most of the companies using the reusable crates (and bottles) would not be able to cope with the economic burden. Or at least, they would not have the resources to invest in new crates and would be likely to switch to one-way packaging. (Brauer-Bund et al. 2008)

EuPC has pointed out that the current production capacity in Europe for crates and pallets is around 55 million units per year. Hence, if only all the current heavy metal containing beverage crates (500 units) were to be withdrawn from circulation and replaced by new ones, this would take 10 years with the current production capacity. In such a situation, some new installations may of course be built, but they would then face shut down in less than ten years.

2.6. INTERNATIONAL DIMENSION

Plastic crates and RTP are typically only used in the limited perimeter allowing a cost effective return of the packaging. Thus, products exported outside of Europe are rather packed in one-way packaging. Consequently, crates and RTP normally stay within Europe.

Pallets are more mobile in an international scale, but the owners of the pallets still have an interest to recover them. Furthermore, as has been described earlier in this report, the scale of the heavy metal problem in pallets is more limited compared to (bottle) crates.

Export at the end-of-life is regulated by the Waste Shipment Regulation[12]. Plastic crates and pallets, being made of HDPE or PP, fall under the category B3010 'Solid plastic waste' in Annex V (Part 1, List B) of the regulation. As provided in the introductory notes of the annex, "waste listed in List B of Part 1 are covered by the export prohibition if they are contaminated by other materials to an extent which

(a) Increases the risks associated with the waste sufficiently [...], when taking into account the hazardous characteristics listed in Annex III to Directive 91/689/ECC.

(b) Prevents the recovery of the waste in an environmentally sound manner".

12 Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

As discussed earlier (see Box 3), whether the crates and pallets fulfil the condition (a) depends on the actual heavy metal content. However, it may be considered that the heavy metal content exceeding 100 ppm prevents recovery in an environmentally sound manner in non-EU countries where close loop recycling cannot be assured. Hence, these crates and pallets fulfil the condition (b) and their export at the end-of-life can be considered forbidden according to the Waste Shipment Regulation

In principle, plastic crates could be exported for recycling, for example to Far East destinations, but in that case the heavy metal containing recyclate will be used to produce any new plastic products, including toys. These products risk then to be imported back to the European market.

3. SUMMARY AND CONCLUSIONS

3.1. SUMMARY

Based on the available information and evidence the use and appropriate recycling and re-manufacturing processes of plastic crates and pallets containing heavy metals would seem to have negligible health and environmental impacts. The weathering effect, which may be relevant in case of granulated material left outside for years, as discussed in the context of landfilling, does not seem to be of relevance for whole crates and pallets in normal use and recycling. Furthermore, when crates and pallets are remanufactured, UV-protector is added to guarantee the resistance of the colour. This also protects the crates and pallets from weathering effect and further reduces the risk of leaching. Most of the contacted stakeholders, including non-industrial experts, agree that keeping the heavy metals in these applications may just be the best option.

Based on the available information, it can be concluded that at present there are no full scale techniques, nor available facilities to extract heavy metals from plastic crates and pallets, conserving the plastic matrix for further use. The developers of the chemical recycling processes in the Netherlands claim that their processes are applicable in large scale and need only investment in a production unit to become operational. However, it is difficult to judge these claims. In the current legal situation there is no interest to make such investments and no further development in these technologies will take place without an active policy for the removal of heavy metals for these products.

If the derogation is not extended, up to 2.5 million tons of heavy metal containing plastic would most probably have to be landfilled or incinerated. In both cases, there seems to be a risk of heavy metals leaching to an environment either directly from granulated/chipped plastic or from landfilled ashes, unless both of these fractions are properly treated as hazardous waste. Furthermore, this would mean that 2.5 million tons of virgin plastics with higher CO_2 emission would be needed to replace the old crates.

Regarding economic impacts, it has been illustrated that due to the structure of the one of the most concerned sectors, beverage manufacturing, the end of the derogation could have disproportionate impacts on a large number of SME. Further, considering the current, installed RTP production capacity in Europe, a sudden end of the derogation would seem to lead to serious supply problems.

Based on the negligible health and environmental impacts of the current situation, the possible risks related to the available disposal options, as well as the economic arguments, national authorities in Austria, Germany and UK support prolongation of the derogation. Positions of other Member States are unknown to the study contractors.

3.2. CONCLUSIONS

Considering that:

- the objective of the Packaging Directive is to prevent any impact of packaging and packaging waste on the environment or to reduce such impact, thus providing a high level of environmental protection, the elimination of heavy metals from plastic crates and pallets should be aimed at;
- the non-prolongation of the derogation would have disproportionate, negative economic impacts on many SMEs and would be likely to lead to supply problems; and that
- technologies exist to extract heavy metals from the plastic matrix, enabling the recovery of the plastic, and that the further up-scaling and development of these technologies is hampered by the lack of incentives to invest under the current derogation,

it is recommended to prolong the derogation for plastic crates and plastic pallets, but only for a limited period (e.g. for another 10 years) during which the industry should progressively eliminate the heavy metals from their crates and pallets using best available techniques to extract heavy metals from the plastic matrix. It would seem important to give an incentive to recycle the crates and pallets chemically, thus preserving the plastic material. Otherwise the plastic crates and pallets will most likely be incinerated (or still landfilled in some Member States) as hazardous waste. In order to verify that the phase out of hazardous substances is feasible within the renewed derogation, the Commission is encouraged to examine the progress in the relevant technologies e.g. 5 years into the prolongation.

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- Mr. Bochicchio, P., EuPC (European Plastics Converters[13])
- Mr. Burghardt, C., InBev
- CIAA - Confederation of the Food and Drink Industries of the EU
- Confederation of Belgian Brewers / Belgische Brouwers / Brasseurs belges
- Mr. Dangis, A., EuPC
- Ms. De Smet, A.-M., The Brewers of Europe
- Mr. De Wijngaert, L., Belgische Brouwers / Brasseurs belges
- Mr. Dopychai, A., Verband Deutscher Mineralbrunnen e.V.
- EEB - European Environmental Bureau
- Ms. Fosselard, P., EFBW (European federation of bottled water)
- Mr. Grippo, P., Nestlé Waters / EFBW
- Mr. Jansen, D., DHV BV
- Ms. Lambert, C., CDLK & Cie / UNESDA (Union of European Beverages Associations)
- Mr. Merkx, B., EuPR (European Plastic Recyclers)
- Orangina Group, S.A
- Mr. van Kasteren, J.M.N., Eindhoven University of Technology
- Mr. Wendt, J., Schoeller Arca Systems B.V.
- Mr. Williams, D.A., EuPC

4.2. MEETINGS & VISITS

- A meeting with EuPC/EuPR, Brussels, BE, 29/07/2008.
- A common meeting with EFBW, Unesda and The Brewers, Brussels, BE, 29/07/2008.

[13] EuPC represents 50 000 – 100 000 companies through national plastic converters' associations

- Visit of a crate recycling and production site of Schoeller Arca Systems B.V., Hardenberg, NL, 13/08/2008.

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ANNEX 1

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Auftragsnummer : 3 5 7 3 5 0 0
Prüfbericht vom : 2.07.2008
Unser Zeichen : NE / NE

P R Ü F B E R I C H T

Untersuchung von	:	Griffleiste, braun Brunnen-Einheitskasten 1 A braun
Probeneingang am	:	09.06.2008
Anzahl Proben	:	1
Ihr Auftrag vom	:	05.06.2008, Hi/kü
Beschreibung	:	aus der Griffleiste eines Mineralwasserkastens herausgetrenntes, ca. 15 cm langes, massives, braunes Kunststoffteil

UNTERSUCHUNGSERGEBNIS

Prüfbeginn : 12.06.2008

SCHWERMETALLE IM KUNSTSTOFF

Blei (AAS) Methode ME073	:	240	mg/kg
Cadmium (AAS) Methode ME073	:	270	mg/kg

Prüfmethode:
Eine zerkleinerte Probe wurde nach Mikrowellenaufschluß auf Blei bzw. Cadmium mittels Graphitrohr-AAS untersucht.

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USt-IdNr.: DE114882606

SPEZIFISCHE MIGRATION
Schweiß-Simulanz gem. DIN 53160
24 h 40 °C, 1 cm² : 1 ml

Blei (AAS) Methode ME073	:	0.6	µg/dm²
Cadmium (AAS) Methode ME073	:	0.2	µg/dm²

Prüfmethode:
Die Metalle wurden in dem Schweißsimulanz gemäß DIN 53160 nach 24-stündigem Kontakt durch Eintauchen direkt mittels Graphitrohr-AAS bestimmt.

BEURTEILUNG

Die nach einem 24-stündigen Kontakt in ein Schweißsimulanz übergegangenen Blei- und Cadmiummengen liegen bezogen auf 1 dm² Kunststoffoberfläche im Spurenbereich. Eine gesundheitliche Gefährdung durch Blei oder Cadmium für Verbraucher ist bei bestimmungsgemäßem Gebrauch der Mineralwasserkästen nach dem Ergebnis unserer Untersuchungen u.E. auszuschließen.

INSTITUT NEHRING GmbH

Dr. Ulrich Nehring

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INSTITUT NEHRING

Laboratorien für Lebensmittel, Bedarfsgegenstände und Umwelt
Institut für Konserventechnologie

AKS Akkreditierung: AKS-PL-20311
Verzeichnis: www.aks-hannover.de
Staatliche Akkreditierungsstelle Hannover

GDB
Genossenschaft
Deutscher Brunnen eG
Postfach 26 01 05

53153 Bonn

Auftragsnummer : 3 5 7 3 5 0 1
Prüfbericht vom : 2.07.2008
Unser Zeichen : NE / NE

P R Ü F B E R I C H T

Untersuchung von	:	Griffleiste, blau Brunnen-Einheitskasten K 1 blau
Probeneingang am	:	09.06.2008
Anzahl Proben	:	1
Ihr Auftrag vom	:	05.06.2008, Hi/kü
Beschreibung	:	aus der Griffleiste eines Mineralwasserkastens herausgetrenntes, ca. 12 cm langes, hohles, mittelblaues Kunststoffteil

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UNTERSUCHUNGSERGEBNIS

Prüfbeginn : 12.06.2008

SCHWERMETALLE IM KUNSTSTOFF

Blei (AAS) Methode ME073	:	150	mg/kg
Cadmium (AAS) Methode ME073	:	410	mg/kg

Prüfmethode:
Eine zerkleinerte Probe wurde nach Mikrowellenaufschluß auf Blei bzw. Cadmium mittels Graphitrohr-AAS untersucht.

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USt-IdNr.: DE114882606

SPEZIFISCHE MIGRATION

Schweiß-Simulanz gem. DIN 53160

24 h 40 °C, 1 cm² : 1 ml

Blei (AAS) Methode ME073	:	0.4	µg/dm²
Cadmium (AAS) Methode ME073	:	0.5	µg/dm²

Prüfmethode:
Die Metalle wurden in dem Schweißsimulanz gemäß DIN 53160 nach 24-stündigem Kontakt durch Eintauchen direkt mittels Graphitrohr-AAS bestimmt.

BEURTEILUNG

Die nach einem 24-stündigen Kontakt in ein Schweißsimulanz übergegangenen Blei- und Cadmiummengen liegen bezogen auf 1 dm² Kunststoffoberfläche im Spurenbereich. Eine gesundheitliche Gefährdung durch Blei oder Cadmium für Verbraucher ist bei bestimmungsgemäßem Gebrauch der Mineralwasserkästen nach dem Ergebnis unserer Untersuchungen u.E. auszuschließen.

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ANNEX 2

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ÜEV – 1	**Packaging– and Packagingwaste – Directive 94/62/EG**
Declaration of transfer by the user *Übergabe-erklärung des Verwenders*	*Verpackungs– und Verpackungsabfall – Richtlinie 94/62/EG* **Derogation 1999/177/EG** *Ausnahmeregelung 1999/177/EG* **Plastic crates, boxes and pallets containing heavy metals** *Schwermetallhaltige Kunststoffkästen und -paletten* **Number of identification:** *Identifikationsnummer*

GÜTEZEICHEN RAL KUNSTSTOFF ERZEUGNISSE

User: ______________________
Verwender:
Address: ______________________
Anschrift
____
____

This form is to be filled out by the user
Dieses Formular ist vom Verwender auszufüllen

Manufacturer of returnable packagings: ______________________
MTV – Produzent ______________________
Value added tax ident.–Nr.:
Umsatzsteuer Ident.–Nr. ______________________
Address:
Anschrift ______________________

Information to the product
Angaben zum Produkt
Kind of article: *Artikel-Art* ☐ **Crate:** *Kasten* ☐ **Pallet:** *Palette*

Type of plastic: *Kunststoffart* ☐ 02 PE-HD ☐ 05 PP ☐ 06 PS

Name of product: *Produktname* ______________________

Number: *Anzahl* __________ **Piece:** *Stück*

Colour: *Farbe* __________

Hereby it is certified that the described product was transfered according to the stipulations mentioned derogation 1999/177/EG.

Hiermit wird bescheinigt, daß das beschriebene Produkt entsprechend der Ausnahmeregelung 1999/177/EG übergeben wurde.

Confirmation of acceptance by the user
Bestätigung der Übergabe durch den Verwender

____
Place, Date *Ort, Datum* **Signature** *Unterschrift*

Weight per piece __________ **kg** *Stück*
Gewicht je Stück
Regrind material __________ **tons** *Tonnen*
Mahlgut nach Vermahlung
Non reuseable material __________ **tons** *Tonnen*
Nicht wiederverwendbarer Anteil

Confirmation of acceptance by the manufacturer
Bestätigung der Übernahme durch den MTV-Produzenten.

____
Place, Date *Ort, Datum* **Signature** *Unterschrift*

Surveillance by Qualitätsverband Kunststofferzeugnisse Bonn
Überwachung durch Qualitätsverband Kunststofferzeugnisse Bonn

Form: Basis for the legal required documentation
Formular für die rechtlich erforderliche Dokumentation