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Analysis of the Chinese PVC Industry

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1. Introduction

PVC plastics that contain chemical additives such as Lead stabilizers and DEHP plasticizers have a proven harmful effect on human health and the environment. In the EU, the use of these toxic additives in PVC products has been restricted or banned and replaced by safer alternatives.

Since these regulatory changes have mostly been confined to the EU and not implemented on a wider international scale, increasing the sustainability awareness and promoting the voluntary substitution of these additives in countries like China has become a top priority.

With the adoption of China's 13th Five-year Plan (2016-2020), high-end, intelligent and green production became a key policy priority to promote the overall improvement of the manufacturing industry. In the upcoming 14th Five-Year Plan (2021-2025), the Chinese government is once again stressing the importance of protecting the environment.

Because China is one of the world's largest producers and users of PVC-resin and PVC-products, the PVC Information Council in Denmark under the European PVC Industry Representation in Denmark and the Danish Environmental Protection Agency have jointly requested that a brief **Analysis of the Chinese PVC Industry** is carried out.

The purpose is to better understand the PVC industry, market forces, regulatory environment, and possible barriers for replacing toxic additives with less harmful substitutes. The intention is to find a way to initiate a dialogue between the European PVC industry (VinylPlus, the Voluntary Commitment of the European PVC Industry) and the Danish Environmental Protection Agency with related key stakeholders in China.

2. Main Supply and Usage of PVC Resin and PVC Products in China.

China is today the world's largest PVC resin producer and consumer.¹ By the end of 2019 there were 73 PVC resin producers in China in which three had an annual production capacity of one million tons or more.²

China uses both the calcium carbide method and ethylene/vinyl method for production of PVC resin in which the former accounts for about 80% of the total production capacity. The calcium carbide method relies on electricity and coal while the ethylene method relies on oil.

Since China has rich coal resources in the north and north-west of the country but limited oil resources, the calcium carbide method accounts for the main portion of the PVC resin production.

Since 2016, the Chinese authorities have tried to tighten the rules governing the PVC industry through consolidation with the aim to upgrade the PVC industry.

Table 1: Annual Production Capacity of PVC Resin in China in 2019 (Unit: 1,000 tons).

Areas	Calcium Carbide	Ethylene/Vinyl	Sum	%
Northwest (i.e., Xinjiang, Qinghai)	12,290	300	12,590	50%
North (i.e., Inner Magnolia)	3,770	2,450	6,220	24.7%
East	830	1,810	2,640	10.5%
Central	1,600		1,600	6.4%
Southwest	1,420		1,420	5.6%
Northeast	490		490	1.9%
South		220	220	0.9%
Total	20,400	4,780	25,180	100%

The Chinese PVC resin producers are located in 21 provinces with the largest concentration in the northwest and north of China.³ The two largest PVC resin producers are in Xinjiang Province with an annual production capacity of 2.2 million tons and 1.2 million tons, respectively.⁴

¹ Business wire, Extract from "Research Report on China's PVC Industry, 2018-2022", www.businesswire.com/news, (accessed December 14, 2020).

² Zhang Peichao, "Current situation and trend of the development of PVC industry in China in 2019," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 141.

³ Zhang Peichao, "Current situation and trend of the development of PVC industry in China in 2019," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 140.

⁴ Business wire, Extract from "Research Report on China's PVC Industry, 2018-2022", www.businesswire.com/news, (accessed December 14, 2020).

From 2015-2019, the annual production capacity of PVC resin in China increased from 23.48 million tons to 25.18 million tons (including 1.19 million PVC paste resin)⁵. In 2019, the production output exceeded 20 million tons.⁶

In 2019, China imported 0.87 million tons of PVC resin and exported 0.71 million tons of PVC resin.⁷

In 2016, China was the largest importer of PVC resin with an import value of USD 683 million followed by Turkey at USD 618.8 million and Italy at USD 598.36 million. In 2016, the US was the largest exporter of PVC resin with an export value of USD 2.12 billion followed by Germany at USD 820 million and China at USD 790 million.⁸

Based on the annual production output and import-export numbers of PVC resin, nearly all of the production (supply) in China is for domestic consumption (demand).

In the past five years, the Parent Consumption⁹ of PVC resin in China steadily increased and reached 20.27 million tons in 2019 with an annual increase of 7.3% compared with 2018.¹⁰

Table 2: Annual Production Capacity and Parent Consumption of PVC Resin in China from 2015-2019 (Unit: 1,000 tons)¹¹

	Annual Capacity	Production	Import	Export	Parent Consumption
2015	23,480	16,190	929	877	16,242
2016	23,260	16,899	867	1,173	16,593
2017	24,060	17,745	1,002	1,103	17,645
2018	24,040	18,739	938	774	18,902
2019	25,180	20,107	874	714	20,267

Note: Parent Consumption = Production + Import – Export

Usage of PVC Products

PVC is mainly used for producing pipes and fittings, profiles, sheets and plates, wallpapers, floorings, film, cables and wires, medical devices, and shoes. These can mainly be categorized in two PVC groups: Rigid and Flexible. Out of the total, 62% of PVC is used for rigid PVC products such as pipes and fittings, profiles, doors and windows, plates and panels.

⁵ Zhang Peichao, "Current situation and trend of the development of PVC industry in China in 2019," China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 139.

⁶ Zhao Guowei, "The operation and development trend of the synthetic resin industry in 2019," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 126, 127,

⁷ Source: National Bureau of Statistics

⁸ PVC Production, Trading Price and Market Demand (2016), www.plasticsinsight.com/resin-intelligence/resin-prices/pvc/ (accessed December 14, 2020).

⁹ Parent Consumption = Production + Import – Export

¹⁰ Zhao Guowei, "The operation and development trend of the synthetic resin industry in 2019," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 139.

¹¹ Ibid., 126, 127, 130, 133.

Table 3: Use of PVC Resin in Products in China 2019 (%)

Application Areas	% of Total PVC Supply	
Pipes and fittings	32.5%	Total used for Rigid Products: 62%
Profiles, doors and windows	21.0%	
Plates, panel and other profiles	5.5%	
Other rigid products	3.0%	
Films	11%	Total Used for Flexible Products: 38%
Flooring, wallpaper and foaming materials	8.5%	
Other flexible products	6.0%	
Electronic cables	5.5%	
Artificial fabric	4%	
Shoes and soles	3.0%	
Total	100%	

The construction sector is one of the most important downstream industries for the PVC industry. In light of the increasing urbanization rate that has grown from 49.23% in 2009 to 60.31% in 2019¹² and the continuing growth of the construction and real estate industries in China, the PVC industry keeps on expanding and upgrading.

Exports of Selected PVC Products

At present, the demand for PVC products in China is mainly generated by the domestic market, and the total export volumes and amounts are relatively low.¹³ Please check the below Table 4 with Chinese export volumes and amounts of some selected PVC products.

¹² Plecher, H. "Urbanization in China 2019." Statista. November 17, 2020. www.statista.com/statistics/455793/urbanization-in-china/ (accessed December 14, 2020).

¹³ Wang Jing, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 150.

Table 4: Exports of Selected PVC Products for 2018, 2019 and January to October 2020¹⁴:

Commodity code (based on HS Code)	Commodity	2020 (Jan-Oct)		2019		2018	
		Export Quantity (Unit: 1,000 tons)	Export Amount (Unit: US\$ mill.)	Export Quantity (Unit: 1,000 tons)	Export Amount (Unit: US\$ mill.)	Export Quantity (Unit: 1,000 tons)	Export Amount (Unit: US\$ mill.)
39181090	Floor coverings of PVC	3,932	4,429.74	4,033.2	4,841.60	3,541.2	4,597.91
39262011	Gloves of PVC	475.1	2,665.98	403.5	986.38	449.5	1,367.59
39172300(00)	Tubes, pipes and hoses, rigid, of polymers of PVC	62.2	116.01	92.7	158.93	83.4	143.11
39162010(00)	Profile shapes of PVC	88	112.91	128.8	167.45	122.4	162.55
39162090(00)	Monofilament & rods & sticks, of polymers of PVC	36.1	59.35	59.3	81.17	56.6	83.56
39181010(00)	Wall/ceiling coverings of PVC	37.0	112.32	47.0	152.93	35.3	109.67
39204300(90)	Plates/sheets/film/foil/strip, of PVC by weight with no less than 6% of plasticizers	228.7	414.52	242.7	453.01	236.2	429.54
39211210(00)	Plates/sheets/film/foil/strip of PVC combined with textile fabrics, cellular	40.5	134.64	59.9	172.22	44.6	143.64
39211290	Other plates/sheets/film/ foil/strip of PVC, cellular	192.5	337.96	230.7	365.79	224.0	349.67
590310	Other insulating cloth or tape impregnated with PVC	N/A	2,020.05	N/A	1,222.84	N/A	N/A
59031010	Textile insulating cloth or tape treated with PVC	21.3	33.79	39.8	62.57	39.3	65.59
59031020	Textile imitation leather treated with PVC	152.1	364.85	242.7	559.60	266.4	596.16
59031090	Other textile fabrics treated with PVC	476.2	824.21	821.0	1,397.88	879.0	1,531.46

Note: The Harmonized System (HS) Code is a standardized numerical method of classifying traded products. It is used by customs authorities around the world to identify products when assessing duties and taxes and for gathering statistics.

¹⁴ Source: Customs statistics <http://43.248.49.97/indexEn>

In recent years, the export of PVC flooring from China has developed rapidly, increasing from 1.39 million tons in 2014 to 4.03 million tons in 2019 with an average annual growth above 20%.¹⁵

Europe and North America are the main markets for PVC flooring which have developed over a long period with high market awareness and acceptance. The top three destinations of China’s total exports of PVC flooring were the USA, Canada and Germany with respective shares of 61%, 5.5%, 4.4% in 2018 and 57.17%, 6% and 4.47% in 2019.¹⁶

Table 5: Distribution of Floor Coverings of PVC Exported in 2018 and 2019 (Unit: 1,000 tons)

	USA	Canada	Germany	Others	Total Quantity
2018	2,157.0	195.8	156.7	1,031.7	3,541.2
%	61%	5.5%	4.4%	29.1%	100%
2019	2,305.9	156.7	180.4	1,390.2	4,033.2
%	57%	6%	4.47%	32.5%	100%

Gloves of PVC is another popular category of goods for export. China exported 449,500 tons in 2018 and 403,500 tons in 2019. Over 50% of the total was exported to the US and over 10% was exported to the EU.¹⁷

See Appendix 1: Relevant Stakeholders for some top exporters of PVC products.

It is important to mention that determining the actual export numbers of PVC products from China that use harmful additives is complicated as traded goods follow the HS Codes that generally classify goods according to product type and material but not the raw materials or ingredients used¹⁸.

As more countries and regions actively respond to and engage in the ongoing Chinese “One Belt, One Road”¹⁹ initiative, Chinese exports of PVC products are expected to increase significantly in the future.²⁰

Government Authorities of PVC Industry

At present, the China plastic products industry is macro-managed by the Chinese government and partly self-regulated by industry associations in a market-based manner.

¹⁵ Zhang Peichao, “Current situation and trend of the development of PVC industry in China in 2019,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 141.

¹⁶ Source: customs statistics.

¹⁷ Ibid.

¹⁸ The rapidly increasing international e-commerce is a growing concern in Europe. Authorities, business organizations and NGO’s are concerned about the potential presence of problematic chemistry in products purchased from sales channels originating outside of Europe. However, it was not possible to collect this documentation of the China e-trade for this analysis.

¹⁹ The “One Belt, One Road” initiative is a global infrastructure development strategy adopted by the Chinese government in 2013 to invest in nearly 70 countries with the aim to enhance regional connectivity and trade by land and sea.

²⁰ Wang Jing, “Plastic Additives,” China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 150.

The National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Housing and Urban-Rural Development, State Administration of Quality Supervision and other relevant government departments provide guiding industrial policies and general supervision of the Chinese PVC industry.

See Appendix 1: Relevant Stakeholders for more information on these authorities.

Organizations

China Plastic Processing Industry Association (CPPIA) was founded in 1989, and is a national, non-profit industrial association for the plastics processing industry in China. CPPIA is voluntarily composed of enterprises, institutions, social groups, scientific research institutes, universities and colleges and individuals engaging in the plastics processing industry and related industries.

CPPIA is guided and supervised by the State-owned Assets Supervision and Administration Commission of the State Council and China National Light Industry Council (CNLIC). There are about 5,000 membership units in CPPIA.

CPPIA assists in formulating relevant industrial policies and standards, and responsible for publicizing and implementing relevant national laws, policies, and decrees, collecting and analyzing technical and economic information from China and abroad, developing market forecasts, reporting important industry situations, proposing suggestions for solving problems.

Under CPPIA, there are 40 professional committees such as: Plastics Pipes, Profiles for Windows and Doors, Medical Plastics, Rigid Sheet of PVC, Low Foamed Rigid PVC Products, Degradable Plastics, Plastics for Recycling, Plastic Additives, Research and Development of New Materials, Education and Training as well as Cooperation Committee of Plastic Technology, Committee of Experts, etc.²¹

See Appendix 1: Relevant Stakeholders for more details on the above organizations.

3. Use of Lead Stabilizers and the Regulatory Environment in China.

Plastic additives are mainly used in PVC, PP, PE and engineering plastics among which PVC consumes about 75% of the total quantity used in China.²² Following the fast development of the plastic industry in China, the annual capacity, production, and consumption of heat stabilizers has also increased.

²¹ Source: www.cppia.com.cn/en

²² Wang Jing, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 150.

Today, the annual capacity of heat stabilizers in China is over 1.5 million tons. In 2019, the production exceeded 700,000 tons (including exports of about 100,000 tons) and the parent consumption was over 600,000 tons.²³

The main types of heat stabilizers are Lead salt heat stabilizers, compound metal heat stabilizers (mainly Calcium and Zinc), organotin heat stabilizers, organic antimony heat stabilizers, and Rare Earth heat stabilizers.²⁴

In 2016, the total consumption of heat stabilizers in China was 650,000 tons with Lead salt heat stabilizers at 227,500 tons (35%), compound metal heat stabilizers at 260,000 tons (40%) and organotin heat stabilizers at 65,000 tons (10%).²⁵

From the consumption figures, Lead salt heat stabilizers are still widely used in China. Alternatively, organotin heat stabilizers have a good thermal stability, weather resistance and transparency, which makes them effective heat stabilizers.²⁶

Due to the adverse effects of Lead on human health and the environment, many countries have limited or banned the use of Lead in PVC products. In China, Lead salt stabilizers are restricted or banned in certain PVC products (mostly toys, children' products, food/water contact materials, and medical devices having direct contact with human blood).

In China, these regulations regarding the restrictions or ban of Lead salt stabilizers are listed in different national standards²⁷ for specific products.

For instance, GB/T 10002.1-2006 ("Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply") stipulates that Lead salt stabilizers should not be used for drinking water pipes.

According to GB 19335-2003 – Blood flow products for single use (general specification) states that "As to the finished products, the total content of barium, chromium, copper, lead and tin in the test solution should not exceed 1ug/ml during the AAS method test according to GB/T 14233.1-1998".

According to GB 18586-2001 - Indoor decorating and refurbishing materials – The limit of harmful substances of polyvinyl chloride floor coverings, Lead migration (soluble Lead) shall not exceed 20 mg/m².

²³ Shi Xunruo, "The current situation and development trend of additives used for PVC products," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press,2020), 182.

²⁴ Wang Jing, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press,2020), 149.

²⁵ Ibid., 150.

²⁶ Tang Wei and CHEN Yu, "Present situation and development trend of PVC heat stabilizers in China," Polyvinyl Chloride 45, no.8 (Aug 2017): 12.

²⁶ Secretary department of Plastic Additives Committee of the China Plastic Processing Industry Association, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 369.

²⁷ GB (Guobiao) standards are the national standards of China.

According to GB 21550-2008 - The restriction of hazardous materials in polyvinyl chloride artificial leather, Lead migration (soluble lead) shall not exceed 90 mg/kg.

According to GB 6675.4-2014 Safety of toys – Part 4: Migration of certain elements, the maximum limits requirements for migratable elements in toys: Lead (Pb): 90mg/kg (clay modelling); 90mg/kg (other toy materials).

See Appendix 2: Regulations and Standards Restricting the Use of Lead Stabilizers

Although there is currently no unified law banning the use of Lead salt stabilizers, the regulatory requirements of environmental protection imposed on manufactories are increasing which puts pressure on manufactories to stop the use of Lead salt stabilizers.

According to the China Plastics Industry Yearbook 2020, 200,000 tons of environmental-friendly heat stabilizers were used for rigid PVC products and 100,000 tons used for flexible PVC products in 2019.²⁸

According to Mr. SHI Xunruo from the Plastic Additives Committee under CPPIA, China focuses more on the development of environmental-friendly additives for rigid PVC which is why the current development and promotion of applying environmental-friendly stabilizers for flexible PVC are lagging behind.²⁹

Mr. SHI Xunruo also see the bans of non-environmentally friendly heat stabilizers containing heavy metals like Lead and Cadmium as the general trend. In his opinion, the development direction of the heat stabilizers industry in the near future, will be the professional application of high-efficiency, compound Zinc-based, non-toxic heat stabilizers and the compound multi-functional organic Tin heat stabilizers, and research and development of the organic compound heat stabilizers.³⁰

4. Use of Problematic Phthalates Plasticizers (DEHP) and the Regulatory Environment in China.

Plasticizers are an important class of additives for improving the performance of flexible PVC products. Today, China is the world largest producer and consumer of plasticizers in which the main plasticizers are still petrochemical products like orthophthalates DOP (DEHP) DBP, DINP and terephthalate DOTP (DEHT).³¹

²⁸ Ibid.

²⁹ Shi Xunruo, "The current situation and development trend of additives used for PVC products," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), page 182.

³⁰ Ibid., page 183.

³¹ Secretary department of Plastic Additives Committee of the Plastic Processing Industry Association, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), page 369.

In 2019, China produced 4.85 million tons of plasticizers (with a consumption of 4.39 million tons) including 1.49 million tons of DOP (DEHP 30.72%), 0.52 million tons of DINP (10.72%), 0.6 million tons of DBP/DIBP (12.37%) and 0.26 million tons of DPHP (5.36%).³²

Several studies have demonstrated that especially the low-molecular weight orthophthalates plasticizers (i.e., DEHP, DBP and DIBP) are harmful to human beings, animals, plants and the environment which is why many countries are exerting more and more control over phthalate plasticizers.

As a result, global consumption of DOP (DEHP) has shown a significant downward trend. In line with the consideration of consumer health, the international requirements for traditional phthalates plasticizers are becoming more and more stringent.

China has released some restrictions that limit or ban the use of DOP (DEHP) plasticizers mainly for products such as toys and children's products, materials and articles intended to get into contact with foods, plastic furniture and medical devices intended to come into contact with human blood, skincare and cosmetics products.³³

Moreover, there are some national standards involving limited use of phthalates in products such as plastic furniture, construction glues, decoration materials, fabric, rubber products, electronic products, shoes and soles, cosmetics.

See Appendix 3: China National Standards and Industry Standards Restricting the Use of Toxic Phthalates Plasticizers.

According to the Plastic Additives Committee under CPPIA: "In recent years, the situation of China's DEHP market is as follows: Market stagnant, over production, harsh conditions in the industry, and thin profits. Although the shrinking of the DEHP market is inevitable, DEHP may not be eliminated in the short term."³⁴

As a result, the pressure on traditionally used plasticizers has increased and forced many manufacturers of PVC products to develop and use environmental-friendly plasticizers to substitute problematic phthalate plasticizers.

The most common environmental-friendly plasticizers are citrate plasticizers with the substances of ATBC and TBC³⁵. Furthermore, there are other alternative environmental-friendly plasticizers such as cycloalkyl dicarboxylate, phosphate esters, epoxy esters, and castor oil derived esters.³⁶

³² Ibid.

³³ Wang Xiaoyan et al., "Overview of Phthalate Plasticizers, Current Regulations and Standards," CHINA PLASTICS 33, no.6 (June 2019): 98.

³⁴ Secretary department of plastic additives committee of the China Plastic Processing Industry Association, "Plastic Additives," in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 369.

³⁵ ATBC: Tributylacetyl citrate and TBC: Tributyl citrate.

³⁶ Wang Xiaoyan et al., "Overview of Phthalate Plasticizers, Current Regulations and Standards," China Plastics 33, no.6 (June 2019): 104.

The annual production of epoxy plasticizers in China in 2019 was 400,000 tons accounting for 8.25% of the total production of plasticizers while the annual production of citrate plasticizers was 75,000 tons in 2019.³⁷

In recent years, DOTP (DEHT) has been widely praised as an environmental-friendly plasticizer in the cable material industry and in the production of disposable gloves which is gradually eroding the DOP (DEHP) market share. In 2019, the production of DOTP (DEHT) plasticizers was 1.32 million tons which is only 170,000 tons less than the DEHP plasticizers with 1.49 million tons.³⁸

Mr. SHI Xunruo from the Plastic Additives Committee under CPPIA is of the opinion that the border line of so-called environmental plasticizers on the market is not clear. Even though DOTP (DEHT) is generally regarded as an environmental plasticizer, its chemical structure is similar to DOP (DEHP) and therefore contributes roughly the same amount of pollution³⁹ to the environment.⁴⁰

Mr. SHI Xunruo also states that: “So far, there are few plasticizer varieties that can completely replace DOP (DEHP) in the domestic market, not even German BASF products⁴¹, and the cost performance index is not enough (domestic consumption still adheres to the tradition of high quality and low price)”.⁴²

5. Waste Management and Recycling.

For a long time, the development of the plastic recycling of waste industry in China was based on the importation of waste plastics from mostly Europe and the US. China started to import solid waste including plastics in the 1980s to make up for an unsatisfied demand for raw materials to produce plastic products.

From 2014-2016, the amount of imported waste plastics reached 8.254 million tons, 7.354 million tons and 7.347 million tons, respectively.⁴³

However, the collection and recycling of domestically generated plastic waste has been less systematic and efficient, mostly relying on private waste collectors and small-scale operators.

³⁷ Secretary department of plastic additives committee of the Plastic Processing Industry Association, “Plastic Additives,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 369.

³⁸ Shi Xunruo, “The current situation and development trend of additives used for PVC products,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 184.

³⁹ This contradicts the general regulatory situation in Europe. According to the notifications provided by companies to the European Chemical Agency (ECHA), no hazardous substances have been classified in their REACH registrations of DEHT.

⁴⁰ Shi Xunruo, “The current situation and development trend of additives used for PVC products,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 184.

⁴¹ BASF has a wide selection of plasticizers in their product portfolio: Phthalate and non-phthalate (e.g. DINCH and Adipate) based. Their general recommendation is that different functional requirements require different plasticizers, but that it is possible to find alternatives to DEHP.

⁴² Shi Xunruo, “The current situation and development trend of additives used for PVC products,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press, 2020), 184.

⁴³ Department of Circulation Industry Development of the Ministry of Commerce & China National Resources Recycling Association, Report of Recycling of Renewable Resources Industrial Development in China (2016, 2018).

In 2017, the General Office of the State Council issued the “Implementation Plan on Banning the Entry of Overseas Garbage and Promoting the Reform of Solid Waste Import Management System” to tighten the regulations and management of solid waste imports.

Accordingly, by late 2017, China banned the imports of solid waste that was causing great environmental damage and raised strong public concerns. By the end of 2019, China phased out the imports of solid waste that can be replaced by domestic resources.⁴⁴ The import of waste plastics fell from 5.829 million tons in 2017 to only 51,000 tons in 2018.⁴⁵

The banning of imported waste also aims to improve the recycling and utilization of domestic solid waste by speeding up the development of the domestic solid waste recycling and utilization system, establishing and improving the manufacturer liability system, and promoting urban and rural household waste classification to improve the recycling and utilization ratio of domestic solid waste. This aims to increase the amount of recycled domestic solid waste from 246 million tons in 2015 to 350 million tons by 2020.⁴⁶

The National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Commerce and Ministry of Housing and Urban-Rural Development are responsible for the long-term implementation.

Several policies have been launched by the Chinese authorities to promote the recycling ratio of waste. In 2017, the National Development and Reform Commission and Ministry of Housing and Urban-Rural Development jointly issued the “Implementation Plan of Domestic Waste Classification System” asking 46 cities to start the mandatory classification of domestic waste which was only recommended in the past.

On 1 January 2018, the revised “Environmental Protection Law of the PRC” took effect with the stated purpose to improve the environment, reduce the discharge of pollutants, and promote ecological progress. As part of the revised Law, environmental protection taxes were introduced to regulate the emissions of pollutants and penalize violations.

In May 2018, the Chinese authorities carried out a series of special investigations on the illegal transfer and dumping of solid wastes to ensure the implementation of the above policies. Thousands of areas were found with problems and ordered to be rectified.⁴⁷

On 29 December 2018, the General Office of the State Council released the “Pilot Work Plan for the Construction of Zero Waste City” that refers to an urban development model that aims to reduce the generation and boost the recycling of solid waste, reducing landfill and

⁴⁴ General Office of the State Council, Notice of the General Office of the State Council on the Promulgation of Implementation Plan on Banning the Entry of Foreign Garbage and Promoting the Reform of Solid Waste Import Management System, Guo Ban Fa [2017] No. 70.

⁴⁵ Department of Circulation Industry Development of the Ministry of Commerce & China National Resources Recycling Association, Report of Recycling of Renewable Resources Industrial Development in China (2019).

⁴⁶ General Office of the State Council, Notice of the General Office of the State Council on the Promulgation of Implementation Plan on Banning the Entry of Foreign Garbage and Promoting the Reform of Solid Waste Import Management System, Guo Ban Fa [2017] No. 70.

⁴⁷ Ministry of Ecology and Environment of the PRC, 2019 Yearly Report of Solid Waste Pollution Environmental Protection and Controlling of large and medium sized cities in China, 2019, 11-12.

<http://www.mee.gov.cn/ywgz/gtfwyhxpj/gtfw/201912/P020191231360445518365.pdf> (accessed December 14, 2020).

minimize the environmental impact of solid waste by promoting green development and green lifestyles.⁴⁸

In January 2020, the National Development and Reform Commission and Ministry of Ecological Environment jointly released the “Opinions of the National Development and Reform Commission and the Ministry of Ecological Environment on Further Strengthening the Treatment of Plastic Pollution”.

According to the “Law of the People’s Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes” (Solid Wastes Law) that took effect on 1 September 2020, solid wastes are categorized as domestic wastes, industrial solid wastes, construction wastes, agricultural solid wastes, and hazardous wastes.⁴⁹

Domestic Solid Waste

Domestic wastes refer to solid wastes generated from daily life and some solid wastes classified as domestic wastes under current laws and regulations.⁵⁰ According to the National Bureau of Statistics of China, domestic wastes generated from 2016-2018 increased from 2.036 to 2.20 billion tons⁵¹ in which plastic wastes accounted for about 12.1%⁵².

The main methods used for the treatment of domestic wastes in China are landfilling and incineration, accounting for 51.3% and 44.67%, respectively in 2018.⁵³

In July 2019, Shanghai became the first city in China to mandatorily implement the classification of domestic waste which has since spread to 46 major cities.

According to the “Administration Rules of Shanghai Domestic Wastes” released in January 2019, domestic wastes are categorized in four groups: Recycled waste, hazardous waste, wet waste and dry waste. PVC products generally fall into recycled waste as there is no separate category for plastic wastes.

Industrial Solid Wastes

Industrial solid wastes refers to solid wastes generated during industrial production⁵⁴. According to the “2019 Report of Solid Waste Pollution, Environmental Protection and Controlling of Large and Medium-sized cities in China” that was based on information collected from 200 selected large and medium-sized cities, about 41.7% of industrial solid

48 General Office of the State Council, Work Plan on “Zero-waste City” Pilot Program in China, Guo Ban Fa [2018] No. 128.

49 Law of the People’s Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes (revised in 2020), Article 124.

50 Ibid.

51 Source: National Bureau of Statistics.

52 “Analysis of Investment in the domestic waste treatment industry,” China Association of Circular Economy, May 8, 2020, <http://www.chinacace.org/news/view?id=11499> (accessed December 14, 2020).

53 Source: National Bureau of Statistics.

54 Law of the People’s Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes (revised in 2020), Article 124.

wastes were recycled, 18.99% were disposed of (landfilled or incinerated), and 39.3% were stored for further action such as recycling, landfill or incineration.

According to a market study of the sources of plastic waste, the scrap material produced during the industrial production process is basically completely recycled.⁵⁵

Construction Wastes

Construction wastes refers to discarded soil, materials and other solid wastes produced in the process of constructing new buildings, rebuilding, expanding and dismantling various buildings, structures and pipelines as well as in the process of house decoration and fitting by residents.⁵⁶ This is the first time that construction waste is defined in the Solid Wastes Law instead of regulations.

At present, China has not established any systematic statistics for construction wastes including PVC building materials, and there are different opinions on the amount of the annually generated construction wastes.⁵⁷

According to the Report of the oversight investigation of the Implementation of the “Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes” that was issued by the “National People’s Congress Standing Committee Law Enforcement Inspection Team” in November 2017, the annually generated construction wastes was about 1.8 billion tons. The Report also states that there are no specific locations for the disposal of most of the construction wastes.⁵⁸

In 2017, the annual generated construction waste was 2.38 billion tons with a recycling rate of only 5% (119 million tons).⁵⁹

There are three main types of construction wastes namely demolition wastes, construction wastes and decoration wastes accounting for 58%, 36% and 6%, respectively. In recent years, the total amount of construction wastes has exceeded 20 billion tons and most of the construction wastes are piled up in open areas or landfilled.⁶⁰

Plastic Wastes

According to Mr. PANG Guanglian, Member of the Standing Committee of the Party Committee and Deputy Secretary-General of the “China Petroleum and Chemical Industry Federation”, the total amount of plastic wastes generated in China in 2019 was 63 million

⁵⁵ Ke Minjing, “Market Study of China Waste Plastics in Recycle and Recovery,” *Plastic packaging* 28, no.3 (2018): 27.

⁵⁶ SW Law (revised in 2020), Article 124.

⁵⁷ LAN Cong, LU Jialin, CHEN Jing and GAO Yuxin, “Status Quo and Development Analysis of Resource Utilization of Construction Waste in China”, *Jiangxi Construction Materials*, (June 2018):20.

⁵⁸ National People’s Congress Standing Committee Law Enforcement Inspection Team, Report of the oversight investigation of the Implementation of the “Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes, by Zhang Dejiang, 2017, <http://npc.people.com.cn/n1/2017/1102/c14576-29622406.html> (accessed December 14, 2020).

⁵⁹ Zhao Shiyong, “Current situation of renewal resource utilization of construction waste”, *Enterprise Technology and Development* 463, no.5 (2020): 129.

⁶⁰ *Ibid.*

tons which also includes plastics in TVs, automobiles and other products that were produced in the past and have now been scrapped.⁶¹

In total, the amount of plastic waste landfilled was 20.16 million tons (32%), the amount for incineration was 19.53 million tons (31%) and the amount of plastic waste recycled was 18.9 million tons (28%) in which the latter shows an increase of 3.3% compared with 18.3 million tons in 2018.⁶²

In terms of the product structure of China’s plastic waste recycling in 2019, PET accounted for 33%, PE for 20%, PP for 19%, and PVC for 15%.⁶³ The recycled waste PVC was about 2.835 million tons in 2019.

6. Barriers for Substitution of Lead Stabilizers and Toxic Phthalates Plasticizers.

The replacement of toxic chemical additives like Lead stabilizers and DEHP plasticizers in PVC products with safer alternatives in China has in recent years received growing attention due to their damaging effect on both human health and the environment.

In the following, we will go through some of the possible barriers for their substitution in China and suggestions/ideas to diminish these. It does not represent a complete and definite list and does not consider to what degree the suggestions/ideas are feasible or not.

Table 6: Possible Barriers for Substitution

Issues	Suggestions/Ideas
Standards and Regulations	
In China, the restrictions on the use of classified phthalates plasticizers and lead stabilizers only apply to limited applications and are still widely used in China.	Identify, contact and meet with experts from relevant industry associations and authorities to promote and discuss restrictions/bans in more areas.
Limitation on the use of the classified phthalates plasticizers and lead stabilizers are spread in different standards and regulations which makes it difficult for users to comply with.	Systematize and unify standards and regulations.
Some current regulations are testing method standards rather than limitation standards which may create market supervision difficulties. ⁶⁴	Include national limitation standards in national testing method standards to strengthen supervision and control.

⁶¹ Pang Guanglian, “Renewal resource utilization of waste plastic, Chemical industry can do it better,” interview by Tang Yin, August 13, 2020, <https://www.chemnews.com.cn/c/2020-08-13/662744.shtml> (accessed December 14, 2020).

⁶² Ibid.

⁶³ Ibid.

⁶⁴ Wang Xiaoyan et al., “Overview of Phthalate Plasticizers, Current Regulations and Standards,” CHINA PLASTICS 33, no.6 (June 2019):103.

Some PVC product standards include clear requirements for the limit of Lead in raw materials but do not provide corresponding inspection and control methods.	Require independent production audits and official inspections to ensure compliance and clamp down on violations.
Technology Development	
Lack of 100% satisfactory replacements. “At present, there are rare substitutes that can completely replace DEHP phthalates plasticizers from the perspective of cost performance.” ⁶⁵	<ul style="list-style-type: none"> • Chinese authorities and PVC industry should promote the use of safer substitutes. • Create industry guidelines on how to use substitutes to ensure consistent product quality. • Support R&D in creating better alternatives with comparable properties.
As Lead salt heat stabilizers have dominated the market for years, and the current equipment mould, technological conditions, and product formulas have reached the overall optimization consistency with Lead salt stabilizers, simply replacing these with environmental-friendly stabilizers may create unexpected results. ⁶⁶	Provide training to technicians and require professional certificates for key positions.
Higher cost of alternative additives. “Development of more environmental-friendly additives is mainly limited by costs.” ⁶⁷	<ul style="list-style-type: none"> • Develop more low-cost, high-performance substitutes. • Tax production of specific toxic additives and/or sales of products containing toxic additives.
Relatively low market entry thresholds which creates fierce competition and low prices that may result in low quality PVC products to ensure profits.	Make it more costly and difficult to obtain licenses for production of PVC products and additives which could lead to consolidation and improve profitability.
Cross-contamination of PVC products without Lead stabilizers with Lead because the same production equipment is used for both types of PVC products due to insufficient control of work processes.	Require separate production equipment to be used for Lead and Lead-free PVC products. Introduce official licenses and certifications for Lead-free production and products. Impose fines on producers for non-compliance.

⁶⁵ Shi Xunruo, “The current situation and development trend of additives used for PVC products,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press,2020), 184.

⁶⁶ Shi Xunruo, “The current situation and development trend of additives used for PVC products,” in China Plastics Industry Yearbook 2020, ed. China Plastic Processing Industry Association (Beijing: China Light Industry Press,2020), 183.

⁶⁷ Wang Xiaoyan et al., “Overview of Phthalate Plasticizers, Current Regulations and Standards,” CHINA PLASTICS 33, no.6 (June 2019):103.

Recycling	
Large amounts of different additives used in PVC products makes it difficult to achieve a recycling quality that is similar to virgin materials.	Introduce industry standards for the use of additives in PVC products according to product types to ensure higher consistency in PVC materials for recycling.
Large quantities of different additives used in PVC products makes it difficult to sort PVC products into uniform waste materials.	Reduce the number and quantities of additives allowed in PVC products. Introduce classification system of plastics according to applications, e.g., pipes, fittings, profiles, etc.
Price difference between new PVC plastics and recycled PVC plastics as raw materials is small whereby the recycling companies are not motivated to collect and recycle PVC waste.	Introduce taxes on the production of new PVC products (or preferential treatment for production of waste PVC products) to make the use of recycled PVC products more economically viable. Provide national subsidies to support the recycling industry.
Classification of solid waste is a new thing in China where plastics are not a separate category for collection which makes it more difficult to sort and recycle PVC products.	Introduce nationwide classification system where all plastics are sorted and collected separately from domestic, industrial and construction wastes.
Management and control of PVC waste products in construction waste is under development and not complete.	Accelerate the implementation of regulations that require the sorting of construction waste according to materials before final recycling.
Big portion of plastic products are sent for landfill and incineration which is harmful to human health and the environment.	Introduce specific regulations that require a high recycling ratio on plastic waste, and tax plastic wastes sent to landfill and incineration. Make producers of (PVC) plastic responsible for collection and recycling (life-cycle).
Local execution of existing environmental regulations is weak with illegal dumping and handling of waste. Rural China covers a huge land area which makes the implementation challenging.	Penalize local governments and companies if they violate the environmental protection law and related regulations while encouraging local recycling efforts through funding and subsidies.
Stricter implementation of environmental regulations pushes out small producers who do not have the means for proper pollution protection.	Encourage or force further industry consolidation and offer other employment opportunities for laid-off personnel.
PVC products made in China and exported to the EU shall meet EU standards. With the development of e-commerce, it is possible to buy and import products with harmful additives from China that may not meet EU regulations.	Introduce international standards and regulations where all (plastic) products including toxic additives must be clearly marked/labelled with the ingredients and quantities used to stop unsafe products being exported/imported including e-

	<p>commerce.</p> <p>Urge e-commerce platform operators to prevent certain products containing toxic additives from being sold online.</p>
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7. Summary and Conclusions.

Today, China is one of the world’s largest producers and users of PVC resin and PVC products which reflects a rapidly expanding economy with growing urbanization, huge infrastructure projects and a construction boom over the last 20 years which has fueled domestic demand.

As a result, the production and use of additives for PVC products has been rising significantly in which both Lead salt stabilizers and DEHP plasticizers are widely used in China.

Presently, the demand for PVC products in China is mainly generated by the domestic market, and total exports are relatively low. However, with the rapid growth of international e-commerce, many private consumers in the EU may (un)knowingly be importing (plastic) products from China that may not meet EU regulations.

With the adoption of China’s current 13th Five-Year Plan (2016-2020), more sustainable and environmentally friendly production has become a key policy area and top priority.

Although no unified national regulations and standards exist on the use of metal stabilizers like Lead and phthalates plasticizers like DEHP in PVC products, many specific product regulations and standards do exist that limit or ban their use. Overall, there is growing regulatory pressure on the Chinese PVC industry to replace the use of harmful additives with safer substitutes.

For many years, China relied on the import of plastic waste including PVC from mostly Europe and the US to meet an unsatisfied demand for raw materials to produce plastic products. As a result, a thriving recycling industry based on imported plastics emerged.

However, the collection and recycling of domestically generated plastic waste has for a long time been less systematic and efficient, mostly relying on private waste collectors and small-scale operators.

In late 2017, China decided to tighten the regulations and ban the import of solid waste including plastics by the end of 2019 as it was causing great environmental damage and public concerns. The aim is to improve the recycling rate and use of domestic solid waste in China.

In July 2019, Shanghai was the first city in China to introduce a mandatory classification and recycling system of domestic waste which has since spread to 46 major cities. Since then, several new national policies and initiatives have been launched to promote the recycling of solid waste including plastics.

Out of the 63 million tons of plastic waste generated in China in 2019, 18.9 million tons (28%) was recycled in which PVC represented 2.835 million tons while 21.6 million tons (32%) went to landfill and 19.53 million tons (31%) for incineration. As such, a huge amount of plastic waste including PVC products is not separated and recycled which is hurting the environment.

Based on our findings, it is clear that the overall Chinese PVC Industry including resin, additives and products have come under strong regulatory pressure in recent years to align with the Chinese governments priorities on developing a greener economy, reduce pollution and improve human health by restricting the use of toxic materials including chemical additives.

As a result, the banning of harmful stabilizers containing heavy metals like Lead and restrictions on the use of phthalates plasticizers like DEHP by using safer alternatives is gaining momentum.

The recent ban of imported solid waste and the law on the prevention and control of environmental pollution by classifying and recycling solid wastes including plastics are important steps in creating public awareness and action to improve living conditions in China.

However, possible barriers do remain that may affect how quickly China can implement and enforce the many new green policies and regulations nationwide, but the direction is clear.

With the launch of the revised Environmental Protection Law on 1 January 2018 and China's coming 14th Five-Year Plan (2021-2025), the Chinese government continues to emphasize the importance of protecting the environment, reducing pollutants and combating climate change.

China is therefore expected to implement a series of ambitious and aggressive plans for green and low-carbon development that among others include green finance, green technological innovation, clean production facilities and green transformation of key industries.

As such, the proactive partnership between the European PVC industry under VinylPlus (PVC Information Council in Denmark) and EU regulators (Danish EPA) on tackling the sustainability challenges of PVC could serve as a template for initiating a close dialogue with similar key stakeholders in China.

8. Way Forward/Next Step

To initiate any fruitful dialogue with the Chinese PVC industry on the challenges and benefits of replacing harmful additives in PVC products with safer alternatives, it is important to engage directly with the actual key stakeholders in China.

A good starting point would be to contact the China Plastic Processing Industry Association (CPPIA) in Beijing that represents 5,000 member units consisting of enterprises, institutions, social groups, scientific research institutes, universities and colleges and individuals

engaged in the plastics processing industry and related industries. It has 40 professional committees including for PVC products and plastic additives.

CPPIA is guided and supervised by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) and is therefore directly connected to the Chinese government and responsible authorities in China.

To get in touch with the right decision-makers in CPPIA, it is important that the initial contact is handled through the right official channels. This could for instance be by sending an official letter on behalf of VinylPlus representing the European PVC industry to CPPIA and ask for a meeting to connect and discuss common challenges and solutions regarding the reduction and banning of harmful additives in PVC.

Based on the initiated dialogue, VinylPlus could propose to organize a joint conference with CPPIA in China where invited industry experts, enterprises and authorities from both China and Europe could exchange know-how, experiences and best practices for mutual benefit and support of the PVC industry.

CPPIA also co-sponsors the annual China Plastics Exhibition & Conference (China PEC) which is currently planned to take place next time in Taizhou in October 2021. As such, a joint forum between CPPIA and VinylPlus could be organized during China PEC to inform about the latest developments and regulatory changes in the European and Chinese PVC industries.

The main aim would be to build personal relations and mutual trust between the parties based on win-win. Europe and China have much to benefit from engaging in a close cooperation on creating a more sustainable and circular world economy that will improve human health and protect the environment.

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Appendix 1: Relevant Stakeholders

Government Authorities	Description	Website
National Development and Reform Commission	Main functions of the NDRC can be found here: https://en.ndrc.gov.cn/mfndrc_8237/200812/t20081217_1193980.html	www.ndrc.gov.cn (English version available)
Ministry of Industry and Information Technology	Ministry of Industry and Information Technology was established in 2008 as a department under the State Council responsible for the administration of China's industrial sectors and information industry. The main responsibilities of the ministry: <ul style="list-style-type: none"> • To determine China's industrial planning, policies and standards • To monitor the daily operation of industrial branches • To promote the development of major technological equipment and innovation concerning the communication sector • To guide the construction of information system • To safeguard China's information security. 	www.miit.gov.cn http://english.www.gov.cn/state_council/2014/08/23/content_281474983035940.htm
Ministry of Housing and Urban-Rural Development	Ministry of Housing and Urban-Rural Development was established in 2008 as a department under the State Council responsible for the administration of construction projects in China. The main responsibilities of the ministry are: <ul style="list-style-type: none"> • To guide the planning and construction of rural and urban areas in China • To establish national standards of construction • To guide construction activity and regulate construction market in China. • To manage the housing and real estate industry. 	www.mohurd.gov.cn
State Administration for Market Regulation	State Administration for Market Regulation is responsible for:	www.samr.gov.cn

	<ul style="list-style-type: none"> • Market entity registration. • Commodity prices. • Anti-monopoly and anti-unfair competition enforcement. • Commercial bribery. • Trademarks and patents infringement. • Food and industrial product safety. • Drug administration. • Quality inspection, certification, and accreditation. 	
State-owned Assets Supervision and Administration Commission of the State Council (SASAC)	An ad-hoc ministerial-level organization directly under the State Council. SASAC is responsible for managing SOEs, including appointing top executives and approving any mergers or sales of stock or assets as well as drafting laws related to state-owned enterprises.	http://en.sasac.gov.cn/
Ministry of Commerce (MOFCOM)	Responsible for formulating policy on foreign trade, export and import regulations, foreign direct investments, consumer protection, market competition and negotiating bilateral and multilateral trade agreements of the Mainland China	http://english.mofcom.gov.cn/
General Office of the State Council	Administrative agency of the State Council which assists the leaders with the day to day administrative operations of the Chinese government.	http://english.www.gov.cn/
Organizations		
China Plastic Processing Industry Association (CPPIA)	National, non-profit industrial organization covering the plastics processing industry in China. CPPIA is voluntarily composed of enterprises, institutions, social groups, scientific research institutes, universities and colleges and individuals engaged in the plastics processing industry and related industry. It is guided and supervised by the State-owned Assets Supervision and	www.cppia.com.cn

	Administration Commission of the State Council and China National Light Industry Council. It has numbers of special committees covering different areas such as plastic additives and PVC products.	
China National Light Industry Council (CNLIC)	CNLIC was established in 2001 by different national level associations, societies, institutions, enterprises, scientific R&D institutes, colleges, and universities in the light industry sectors. It is a nationwide comprehensive legal social organization registered under the Ministry of Civil Affairs. Its goal is to act as a bridge between the government and enterprises by representing a wide range of service and production enterprises. The organization also promotes the development of light industry in China and strengthens international exchange and cooperation.	www.cnlic.org.cn/#
Green Recycling Plastic Supply Chain Group	<p>Led by the China Petroleum and Chemical Industry Association and China National Resources Recycling Association. Officially launched on 23 June 2020 and consists of 16 members.⁶⁸</p> <p>GRPG works to solve the bottlenecks in the creation of the plastic recycling economy through cooperation with important stakeholders, build a standard and evaluation system that is recognized by the whole recycled plastic industry chain, open up all links in the plastic industry chain, and promote the application of green recycled plastics as well as the construction of a green plastic supply chain to explore a new model for the development of the plastic circular economy in China and world.</p>	

⁶⁸ http://www.replastics.org/news_detail.php?id=502.

<p>China Association of Circular Economy (CACE)</p>	<p>CACE is a nationwide organization that spans various industries. CACE is under the administration of the State-owned Assets Supervision and Administration Commission of the State Council and is guided by the National Development and Reform Commission and other government departments.</p> <p>CACE carries out the fundamental state policy of resource conservation and environmental protection and implements the Circular Economy Promotion Law. Relying on the members and connecting with all parties, CACE plays the role as a bridge and makes active contributions to establishing the resource recycling system covering the whole of society, improve resource utilization efficiency, prevent pollutions at source, promote green, circular and low-carbon development, accelerate ecological civilization construction and transformation to a green economy.</p> <p>CACE formulates strategic planning for government on the development of circular economy, improves standards and regulations and policy mechanism, promotes technology progress, develops demonstration sites and pilots, and strengthens dissemination and trainings, enhances supervision and management, and provides technical supports.</p> <p>CACE is also responsible for formulating development planning and implementation schemes for the industries, enterprises and members, promoting advanced technology and business models, offering project verification, matchmaking and investment and financing services, and consulting services on policies, management, technology and markets information, reflecting demands and policy suggestions of enterprises, and finally promoting the healthy development of circular economy in accordance with the relevant laws and regulations.</p>	<p>www.chinacace.org</p>
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China Petroleum and Chemical Industry Federation (CPCIA)	Non-government, non-profit organization consisting of companies, institutes, sectional associations and local associations in the petroleum and chemical industry. It is the umbrella organization that provides service and implements certain administrative functions within this industry on the national level.	www.cpcia.org.cn
Exporters		
<p>Below are Some Top Export Enterprises of Selected PVC Products</p> <p><u>Product: HS 3918109000 Floorings of PVC:</u></p> <ul style="list-style-type: none"> - Taizhou Huali New Materials Co., Ltd. (Hualifloors.com/en/index.html) - Tianzhen Bamboo Flooring Co., Ltd. (www.tzflooring.com) - Yihua Rundong Plastic Flooring Co., Ltd. (Yihuaplastic.com/factory/) <p><u>Product: HS 3926201100 Gloves of PVC:</u></p> <ul style="list-style-type: none"> - Bluesail Medical Co., Ltd., commonly referred to as Bluesail (https://www.bluesail.cn/en/index.php) - Zhonghong Pulin Medical Product Co., Ltd. (en.zhonghongmedical.com) - Wally Plastic Co., Ltd. (www.wallyplastic.com/en/index.php) 		

Appendix 2: Regulations and Standards Restricting the Use of Lead Stabilizers

The restrictions on the use of Lead are spread over a large number of regulations and standards made for specific products. Certain product standards are supplemented by a separate test method standard.

Moreover, if any PVC products are to be used for a specific purpose, the regulations and standards that apply to the referred purpose shall also apply to the PVC products no matter if the same restrictions have been stated in the PVC standards.

For instance, PVC pipes used for drinking water shall comply with the PVC product standard GB/T 17219 (“Standard for safety evaluation of equipment and protective materials in drinking water system”) and the hygiene standard “Standard for safety evaluation of equipment and protective materials in drinking water system” and ensure that transferred water shall meet the requirements of the “standards for drinking water quality”.

The restrictions of the use of Lead in PVC products can be complicated and difficult to understand by the users and can be a challenge to apply.

Below is an incomplete list of regulations and standards applicable to PVC products and general products (including but not limited to PVC products).

Standard No.	Name of Regulations/Standards	Requirements
Pipes and Fittings		
GB/T 17219-1998	Standard for safety evaluation of equipment and protective materials in drinking water system	
GB/T 4219.1-2008	Plastics piping system for industrial applications - Unplasticized poly (vinyl chloride) (PVC-U) - Specifications for components and the system - Part 1: Pipes	When transporting carbonic acid, food and beverage, and medicine, its hygienic performance should be implemented in accordance with relevant standards. Mark: relevant sanitary standard number (when applicable)
GB/T 10002.1-2006	Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply	Lead salt stabilizers should not be used for drinking water pipes, and the sanitary performance should meet the requirements of GB/T 17219-1998.
GB/T 10002.2-2003	Fittings made of unplasticized poly (vinyl chloride) (PVC-U) for water supply	
GB/T 10002.3-2011	Valves made of unplasticized poly (vinyl chloride) (PVC-U) for water supply	
GB/T 18993.1-2003	Chlorinated poly (vinyl chloride) piping	

	system for hot and cold water installations, Part 1: General	
GB/T 18993.2-2003	Chlorinated poly (vinyl chloride) piping systems for hot and cold water installations, Part 2: Pipes	
GB/T 18993.3-2003	Chlorinated poly (Vinyl chloride) piping systems for hot and cold water installations, Part 3: Fittings	
GB/T 27725-2011	Butterfly valves of thermoplastics materials	
GB/T 28494-2012	Globe valves of thermoplastics materials	
GB/T 32018.1-2015	Modified impact resistance poly (vinyl chloride) (PVC-M) pipe system for water supply, Part 1: Pipes	
GB/T 32018.2-2015	Modified impact resistance poly (vinyl chloride) (PVC-M) pipe system for water supply, Part 2: Fittings	
CJ/T 218-2010	Acrylic copolymer together with PVC pipes and fittings for water supply.	
CJ/T 272-2008	Impact-resistant modified polyvinyl chloride (PVC-M) pipes and fittings for water supply	
CJ/T 308-2009	Unplasticized polyvinyl chloride (PVC-U) pipes for water wells	
CJ/T 445-2014	Impact and compression biaxially oriented PVC pipes and connectors for water supply.	
CJ/T 493-2016	High-performance rigid PVC pipes and connectors for water supply.	
Shape		
GB/T 8814-2017	Unplasticized polyvinyl chloride (PVC-U) profiles for the doors and windows	
Flexible PVC Products		
GB/T 3830-2008	Calendared film and sheet from flexible polyvinyl chloride	
GB 10010-2009	Plasticized polyvinyl chloride (PVC) tubing for medical uses	Finished product: the total content of heavy metals in the test solution $\leq 1 \mu\text{g}/\text{ml}$
GB 10457-2009	Plastic cling wrap film for keeping fresh of food	
GB/T 15593-1995	Plasticized polyvinyl chloride (PVC) compounds for transfusion (infusion) equipment	Heavy metal content $\leq 0.3 \mu\text{g}/\text{ml}$
GB 19335-2003	Blood flow products for single use -	The polyvinyl chloride material of

	General specification	the pipeline in direct and indirect contact with blood should meet the requirements of GB 15593. Finished product: During the AAS method test according to GB/T 14233.1-1998, the total content of barium, chromium, copper, lead and tin in the test solution should not exceed 1ug/ml.
JB/T 11376-2013	PVC reflective film	
QB/T 4043-2010	PVC artificial leather for automobile	
QB/T 4042-2010	PVC coating membrane material	
QB/T 4344-2012	PVC artificial leather for skirt belt.	
Floor Tiles and Flooring		
GB/T 4085-2015	Semi-rigid polyvinyl chloride floor tiles	Shall meet the requirements of GB 18586. (Lead migration (soluble Lead) \nlessgtr 20 mg / m ²)
GB/T 11982.1-2015	Polyvinyl chloride floor coverings, Part 1: Heterogeneous polyvinyl chloride floor coverings	The limit of hazardous substances shall meet the requirements of GB 18586. (Lead migration (soluble Lead) \nlessgtr 20 mg / m ²)
GB/T 11982.2-2015	Polyvinyl chloride floor coverings, Part 2: Homogeneous polyvinyl chloride floor covering	The limit of hazardous substances shall meet the requirements of GB 18586 (Lead migration (soluble Lead) \nlessgtr 20 mg / m ²)
GB/T 22789.1-2008	Plastics - Unplasticized poly (vinyl chloride) sheets - Types, dimensions and characteristics, Part 1: Sheets of thickness not less than 1 mm	
GB/T 34440-2017	Rigid polyvinyl chloride flooring	Soluble Lead content \leq 20 mg/m ²
HG/T 3747.3-2006	Rubber and plastic flooring materials Part 3: Flame retardant PVC flooring	The release limit of soluble heavy metals shall be implemented in accordance with the provisions of GB 18586. (Lead migration (soluble Lead) \nlessgtr 20 mg / m ²)
LY/T 1279-2008	Artificial board with PVC film for surface decoration	
Standards Relevant for PVC products		
GB 4806.7-2016	National Food Safety Standard - Plastic Materials and Articles used in Food-contact	
GB/T 5009.67-2003	Method for analysis of hygienic standard of products of polyvinyl chloride for food packaging	

GB/T 5750.6-2006	Standard examination methods for drinking water - Metal parameters	
GB/T 14233.1-2008	Test methods for infusion, transfusion, injection equipment for medical use, Part 1: Chemical analysis methods	
GB/T 17219-1998	Standard for safety evaluation of equipment and protective materials in drinking water system	
GB/T 17593.1-2006	Textiles - Determination of heavy metals, Part 1: Atomic absorption spectrophotometry	
GB 18006.1-2009	General requirement of plastic disposable tableware	
GB 18585-2001	Indoor decorating and refurbishing materials-Limit of harmful substances of wallpapers	
GB 18586-2001	Indoor decorating and refurbishing materials-Limit of harmful substances of polyvinyl chloride floor coverings	Lead migration (soluble Lead) \nlessgtr 20 mg / m ²
GB 21550-2008	The restriction of hazardous materials in polyvinyl chloride artificial leather	Lead migration (soluble Lead) \nlessgtr 90 mg /kg
GB/T 22930-2008	Leather and fur - Chemical tests - Determination of heavy metal content	
GB 28481-2012	Limit of harmful substances of plastic furniture	Lead migration (soluble Lead) \leq 90 mg /kg
GB 31604.9-2016	National Food Safety Standard-Food contact materials and products-Determination of heavy metals in food simulants	
GB/T 33284-2016	Indoor decoration and refurbishing materials—Limit of harmful substances of unplasticized polyvinyl chloride (PVC-U) profiles for the doors and windows	
SJ/T 11365-2006	Detection methods of toxic and hazardous substances in electronic information products	
SN/T 1888.5-2007	Hygienic standard of import/export food packaging containers and materials for irradiated food Part 5: PVC products	
SN/T 1891.4-2007	Hygienic standard of import/export food packing containers and materials for microwave Part 4: PVC products	
GB 6675.4-2014	Safety of Toys – Part 4: Migration of certain elements	Maximum limit requirements for migratable elements in toys:

		Lead (Pb): 90mg/kg (clay modelling); 90mg/kg (other toy materials)
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There are also some draft standards under development involving the restrictions on the use of Lead in PVC products.

China Industry Standards System

Prefix Code	Industry Sector	Issuing Authority/Agency
GB, GB/T, GB/Z	National Standards	Standardization Administration of the PRC
CJ, DJ/T, CJT	Urban Construction	Ministry of Housing and Urban-Rural Development of PRC
HG, HG/T, HGT	Chemical Industry	Ministry of Industry and Information Technology of PRC
JB, JB/T, JBT	Machinery	Ministry of Industry and Information Technology of PRC
LY, LY/T, LYT	Forestry	National Forestry and Grassland Administration
QB, QB/T, QBT	Light Industry	Ministry of Industry and Information Technology of PRC
SJ, SJ/T, SJT	Electronics	Ministry of Industry and Information Technology of PRC
SN, SN/T, SNT	Commodity Inspection	General Administration of Quality Supervision, Inspection and Quarantine of PRC
YY, YY/T, YYT	Medicine & Medical Device	China Food and Drug Administration

Note:

GB standards are the China national standards, also called as “Guobiao Standards”, China GB standards are classified as two stages, Mandatory or Recommended. Mandatory standards have the force of law as do other technical regulations in China. They are enforced by laws and administrative regulations and concern the protection of human health, personal property and safety. All standards that fall outside of these characteristics are considered Recommended standards.

The Prefix Codes without T are Mandatory standards, Prefix Codes with T are Recommended standards (Quasi-Mandatory standards).

Appendix 3: China National Standards and Industry Standards Restricting the Use of Toxic Phthalates Plasticizers.

Standard No.	Name of Standards and Regulations	Restrictions
Toys and Children's Products		
GB 6675.1-2014	Toy Safety Part 1: Basic Code	The use of six plasticizers (DBP, BBP, DEHP, DNOP, DINP, and DIDP) in plastic toys or toy components must not exceed 0.1% of the material composition.
GB 24613-2009	Limit of harmful substances of coating for toys	The use of six plasticizers (DBP, BBP, DEHP, DNOP, DINP, and DIDP) in coating for plastic toys must not exceed 0.1% of the material composition.
GB/T 22048-2015	Determination of certain phthalate esters in toys and children's products	
Food Contact		
GB 9685-2016	National food safety standard Using Standard of Food Contact Materials and Articles Additives	Standard for the use of additives in Food Contact Materials sets out a positive list of additives that can be used to produce various food contact materials and articles including their use, scope and restrictions.
GB 5009-271-2016	National food safety standard - Determination of phthalates in food	
GB 31604.30-2015	National food safety standard for food contact materials and articles. Determination of phthalate esters and migration amount of phthalate esters	
Medical Devices		
GB 14232.1-2004	Plastics collapsible containers for human blood and blood components Part1: Conventional containers	Alcohol extract \leq 15 mg / 100 ml
GB 15593-1995	Plasticized polyvinyl chloride (PVC) compounds for transfusion (infusion) equipment	Alcohol extract (DEHP) shall be processed according to GB / T14232, MF model: Alcohol extract \leq 10 mg / 100 ml
GB 24786-2009	Single-use medical PVC examination gloves	The packing should indicate the following:" the product contains plasticizers that may be harmful to users (the nature of the plasticizer should be disclosed)
YY/T 0927-2014	Guidance of determination for di (2-ethylhexyl) phthalate (DEHP) released from PVC medical devices	

YY/T 0926-2014	Quantitative analysis of DEHP in PVC medical devices.	
SN/T 0323.3-2007	Rules for the inspection of imported and exported medical equipment. Part 3: Plastics collapsible containers for human blood. Blood components conventional containers	Alcohol extract $\leq 15\text{mg}/100\text{ml}$
SN/T 1779-2006	Determination of phthalate plasticizers in plastic bags for human blood and blood components. Gas chromatography-mass spectrometry method	
Other		
GB 28481-2012	Limit of harmful substances in plastic furniture	DEHP, DBP, BBP, DNOP, DINP, DIDP $\leq 0.1\%$
GB 30982-2014	Limit of harmful substances in architectural wall coatings	Phthalate esters exceed 2% of the total mass, please indicate the type, name and number of additives on the outer packaging
GB 3838-2002	Environmental quality standards for surface water	DEHP $\leq 0.008\text{mg}/\text{L}$, DBP $\leq 0.003\text{mg}/\text{L}$
GB 5749-2006	Standards for drinking water quality	DEHP $\leq 0.008\text{mg}/\text{L}$, DBP $\leq 0.003\text{mg}/\text{L}$, DEP $\leq 0.3\text{mg}/\text{L}$
GB/T 33284-2016	Indoor decorating and refurbishing materials – Limit of harmful substances of unplasticized (PVC-U) profiles in doors and windows	DEHP $\leq 1000\text{mg}/\text{kg}$
GB/T 28489-2012	Limits of hazardous substances in musical instruments	DEHP+DBP+BBP $\leq 0.1\%$ DINP+DIDP+DNOP $\leq 0.1\%$
GB/T 20388-2016	Textiles—Determination of the phthalate content—Tetrahydrofuran method	
GB/T 24168-2009	Determination of the content of phthalate in textile dyeing and finishing auxiliaries	
GB/T 29608-2013	Rubber product - Determination of phthalate acid esters	
GB/T 29786-2013	Determination of phthalates in electrical and electronic equipment - Gas chromatography-mass spectrometry	
GB/T 30646-2014	Determination of phthalate plasticizers content in coatings - Gas chromatography/mass spectrometry method	
GB/T 32440-2015	Footwear - Critical substances potentially present in footwear and footwear components -Determination of phthalates in footwear materials	
GB/T 35772-2017	Rapid detection of phthalate esters in polyvinyl chloride products - Infrared spectrometric method	
GB/T 28599-2012	Determination of phthalate esters in cosmetics	

GB/T 35923-2018	Optical functional film - Cellulose triacetate (TAC) film -Determination of plasticizer content	
GB/T 35104-2017	Determination of plasticizers (phthalic acid esters) in fertilizer - Gas chromatography-mass spectrometry (GC-MS)	
GB/T 34715-2017	Thermoplastic elastomer - Determination of phthalates -Gas chromatography-mass spectrometry	
GB/T 39110-2020	Consumer product - Plastics -Rapid screening of phthalates	
GB/T 39234-2020	Determination of phthalate esters in soil - Gas chromatography-mass spectrometry (GC-MS)	
GB/T 28599-2020	Determination of phthalate esters in cosmetics	

There are a number of standards under development involving restrictions on the use of phthalates plasticizers.

China Industry Standards System

Prefix Code	Industry Sector	Issuing Authority/Agency
GB, GB/T, GB/Z	National Standards	Standardization Administration of the PRC
SN, SN/T, SNT	Commodity Inspection	General Administration of Quality Supervision, Inspection and Quarantine of PRC
YY, YY/T, YYT	Medicine & Medical Device	China Food and Drug Administration

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