

Beer Supply Chain Environmental Impact Analysis



Institute of Public & Environmental Affairs

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China's Beer Industry

World's #1 Producer & Consumer Industry is Highly Concentrated

Fragmented Consumption Is Leading to Industrial Restructuring

Since 2002, China has been the world's largest producer and consumer of beer. In 2016, China's annual beer production exceeded 45.064 billion liters, totalling about twice as much as that of the U.S., the world's second largest producer. Annual per capita beer sales topped 35 liters, surpassing the world's average (26.4 liters/person).¹

China's beer industry is highly concentrated, resulting in limited competition due to the small number of producers. The beer market began to consolidate in the early 1990's, undergoing a series of corporate mergers and acquisitions, but this pattern has since stabilized.

At present, China's beer industry is monopolized by five major brands: China Resources Snow ("CR Snow"), Tsingtao Beer, Anheuser-Busch InBev ("AB InBev"), Yanjing Beer and Carlsberg. In 2016, these five companies comprised over 75% of the market, with the largest domestic beer enterprise – CR Snow – accounting for 26% (see Figure 1).

With the beer industry making great strides, China's domestic market has entered into a slump since 2014. Aging populations, increasing incomes and structural changes in market demand have led to a continuous decline in beer production. Small breweries have become unsustainable due to losses, and the performance of major companies, such as CR Snow, Yanjing Beer and Tsingtao Beer, has also declined. Carlsberg even successively closed eight loss-making breweries in China.

On the other hand, between 2011 and 2016, the total amount of imported beer, which is dominated by high-end products, has increased tenfold. Craft beer has grown at a rate of around 40%.² A variety of taprooms and craft brewing labels have rapidly emerged: Beijing-based Panda Brewing, NBeer, and Jing A, as well as The Brew and Boxing Cat in Shanghai, have all become familiar names for beer lovers.

These trends highlight that consumer stickiness toward traditional beer brands has diminished, and consumption patterns are becoming increasingly fragmented and individualized. Traditional beer brands are facing immense market challenges. Major beer brands are gradually shifting toward the high-end market, where consumption is increasing. Their operating conditions have generally improved since the end of 2016.³

China's beer industry is currently ushering in a period of deep consolidation. Product quality upgrades and innovation in production technologies will be two major tests that beer companies must face.⁴

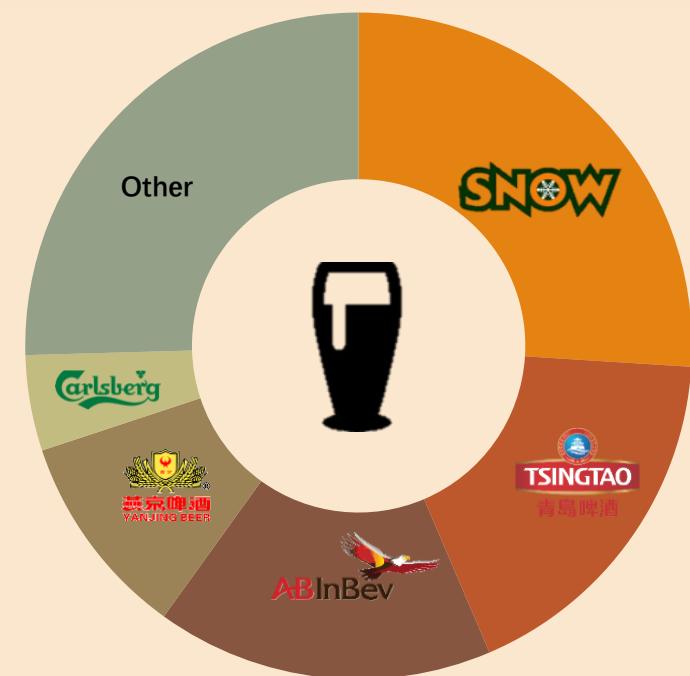


Figure 1. 2016 Market Share of Five Main Beer Companies in China
(Data Source: China Production Info Net⁵)

Heavy Polluting Segments of Beer Production

As early as 2010, China's Ministry of Environmental Protection formulated the Cleaner Production Audit Guideline – Brewing Industry (Draft for Comment), which pointed out the beer industry's low resource and energy use efficiency, severe environmental pollution, and low economic efficiency. The industry needs to implement a more robust sustainable development model based on circular economy and strengthening cleaner production. However, when compared to other traditional heavy industries such as cement and iron & steel, the beer industry's environmental issues have yet to attract widespread attention.

Therefore, we hope that investigating the environmental pollution in beer supply chains will draw the public's attention toward the environmental burden of beer production, and that through multi-stakeholder participation, we can promote enterprises upstream and downstream in beer production value chains to improve their environmental performance and make a green transition.

The aforementioned beers typically use two types of packaging: cans and bottles. Among these two types, bottled beer – which accounts for over 90% of beer⁶ – mainly consists of the four components of beer, bottles, caps, and labelling. The required raw materials, production process, and key pollution emissions impacts can be seen in Table 1 below.

Table 1. Main Production Processes, Inputs & Outputs, and Selected Manufacturers for Bottled Beer

	Beer	Beer Bottles	Bottle Caps	Labelling
• Main raw materials	Malt, water, hops, yeast	Sand, limestone, soda ash, glass slag, manganese dioxide	Tinplate or chrome-plated sheet metal, aluminum, or stainless steel	Aluminized paper or wet strength paper, casein glue
• Production process	Starch conversion → boiling → fermentation → packaging	Mixing → High-temperature melting → Molding → Annealing → Packaging	Printing → Cleaning → Stamping → Packaging	Wet strength paper → Printing & drying → Vacuum coating → Printing & drying → Re-wetting → Pressure printing → Cutting → Packaging
• Main pollutants	Processing wastewater, boiler exhaust gas, carbon dioxide, beer residue, odor	Dust, boiler exhaust gas, processing wastewater	Dust, processing wastewater, noise pollution	Volatile organic compounds (VOCs), solid waste, processing wastewater
• Selected suppliers	<ul style="list-style-type: none"> • China Resources Snow • Tsingtao Beer • Yanjing Beer • Anheuser-Busch InBev • Carlsberg 	<ul style="list-style-type: none"> • Yamamura Glass Qinhuangdao • Qinhuangdao Suokun Daily Glass Group • Huaxing Glass • Qingdao Laoshan Glass 	<ul style="list-style-type: none"> • Shandong Lipeng Co., Ltd. • Foshan Dingzhong Machinery • Zhejiang Xinye Packing Co., Ltd. 	<ul style="list-style-type: none"> • Jiaxing Haoneng Industries Corp., Ltd. • Guangdong Mancheong • Zhejiang Ideal Packaging Group Co., Ltd.

Brewing Segment Yields Highest Water Consumption and Wastewater Discharge

The process for brewing beer mainly consists of four steps⁷ (see Figure 2):

1. **Starch Conversion:** Water is added to malt in order to produce maltose, and the residue is then filtered to separate out a sweet liquid called wort;
2. **Boiling:** Different types of hops are added to the wort, and the substance is then boiled to lock in the flavor of the hops;
3. **Fermentation:** Yeast is added to the rapidly cooling wort for fermentation, where maltose is broken down into alcohol and carbon dioxide;
4. **Packaging:** The beer created by fermentation processes is filtered and dispensed into beer barrels, glass bottles or cans.

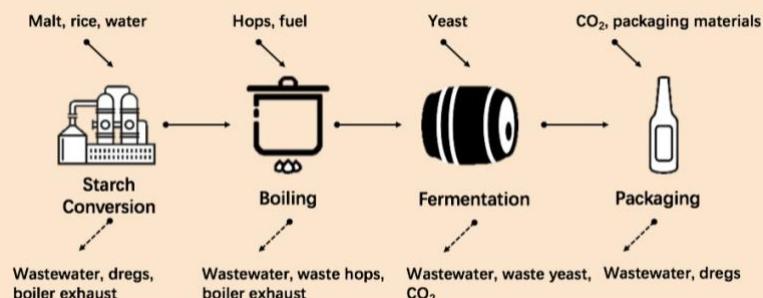


Figure 2. Manufacturing Process and Inputs & Outputs for Brewing

The process for brewing beer consumes a large amount of water, some of which is used as processing water, with the rest used as cooling, washing and sanitation water.⁸ Based on data disclosed in beer brands' annual reports as well as academics' life-cycle analysis of beer production, brewing one liter of beer requires between 3.2 and 4 liters of water.^{9^{10¹¹}} Thus, according to China beer consumption statistics from 2016, producing 45.06 billion liters of beer requires as much as 140 to 180 billion liters of water.



Beer brewing is a major emitter of wastewater.

Waste wort and yeast from starch conversion processes, water from washing pipes, and filtering and rinsing water all contain high concentrations of organic matter.

Brewing processes emit exhaust gas from boilers, as well as large amounts of carbon dioxide.

Beer dregs and other organic wastes are also produced.

Repeated Violations at Subsidiaries to Five Major Beer Brands

Investigations of subsidiaries to the five main beer companies in China revealed different levels of environmental violations at subsidiary factories to all of the five brands (see Figure 3).



Figure 3. Environmental Violations at Subsidiaries to Five Main Beer Brands between 2014 and 2017
(Data Source: Blue Map Database)



CR Snow

China's largest beer enterprise, CR Snow, has a total of 98 factories in China. Among these factories, 23 sites have had issues with wastewater and/or air emissions exceeding legal standards and procedural violations since 2014 (see Figure 5 and Table 1 in the appendix).

Among these subsidiaries, in November 2016, China Resources Snow Breweries (Mianyang) Co., Ltd.'s supervisory monitoring showed that its Chemical Oxygen Demand (COD) discharge was 4.2 times higher than the

discharge standard. Its COD from January 2017 exceeded legal standards by 1.7 times, and in April of the same year, its biochemical oxygen demand (BOD) exceeded standards by 4 times, with its COD also in excess of standards by a multiple of 3.7.¹²

Apart from this, China Resources Snow Breweries (Beijing) Co., Ltd. was punished by the Beijing Municipal Environmental Protection Bureau in 2017 for directly discharging untreated exhaust gas from anaerobic wastewater treatment processes. From December 2016 through April 2017, the factory used 48 types of high energy-consuming electromechanical equipment for starch conversion, filtering, refrigeration and sewage treatment processes, violating China's Energy Conservation Law.

In its 2016 Corporate Social Responsibility (CSR) Report, CR Snow boasted of its total investment in environmental protection and that it has "established a sound three-level environmental management system comprising of the headquarters, regional offices and factories"¹³ (Figure 4). However, many of its subsidiary factories have received environmental violations, showing that CR Snow has not yet achieved environmental compliance in its production, and urgently needs to improve the environmental performance of its subsidiaries.

體系建設 System establishment

We actively implement environmental protection management accountability, and have established a sound three-level environmental management system comprising of the headquarters, regional offices and factories. In addition, we have formulated the plan for environmental



Figure 4. China Resources Snow Breweries' 2016 Annual CSR Report¹⁴

Tsingtao Beer, Yanjing Beer



Tsingtao Beer and Yanjing Beer have 15 and 14 subsidiary breweries, respectively, that have been subject to environmental violations since 2014 (see Figures 6 & 7, and Tables 2 & 3 in the appendix).

Yanjing Beer (Qufu Sankong) Co., Ltd., which is located in Jining city, has been punished a total of 26 successive times since 2015 by local environmental authorities in their monthly “New Air Pollutant Standards Implementation Summary” for its nitrogen oxide (NO_x), sulfur dioxide (SO_2) and particulate air emissions being noncompliant with legal standards due to a lack of denitrification equipment.¹⁵

Yanjing Beer (Laizhou) Co., Ltd. has also been punished 20 consecutive times since 2014 for its lack of denitrification equipment and its particulate emissions exceeding standards. In 2016, the factory was fined 117.930 million RMB for directly discharging a portion of production wastewater from its brewing plant and all of the production wastewater from its draught beer workshop into the environment without first treating it. The general manager as well as the deputy director of the energy conservation and environmental protection department were subjected to 12 days of administrative detention, and seven related persons received official warnings and other disciplinary sanctions.¹⁶

Meanwhile, Yanjing Beer’s 2016 Corporate Social Responsibility Report emphasized, “During the reporting period, the company’s pollution treatment equipment continued to operate stably, and pollutant discharge complied with standards. Pollution control and pollutant discharge results all passed inspections by environmental authorities all levels.”¹⁷ Yanjing Beer was also featured in Southern Weekend’s 2016 “China Greenwashers List” as a result of its subsidiary factories’ repeated violations.¹⁸



AB InBev, Carlsberg

The two companies with the lowest market share in China – AB InBev and Carlsberg – were found to have five and three subsidiaries, respectively, that received violations since 2014 for issues such as wastewater noncompliance (see Tables 4 & 5 in the appendices). Of these two companies,¹⁹ Carlsberg’s subsidiary, Chongqing Brewery Co., Ltd. (Mawangxiang), was the subject of official public reports in 2015 due to its excessive odor and noise pollution.



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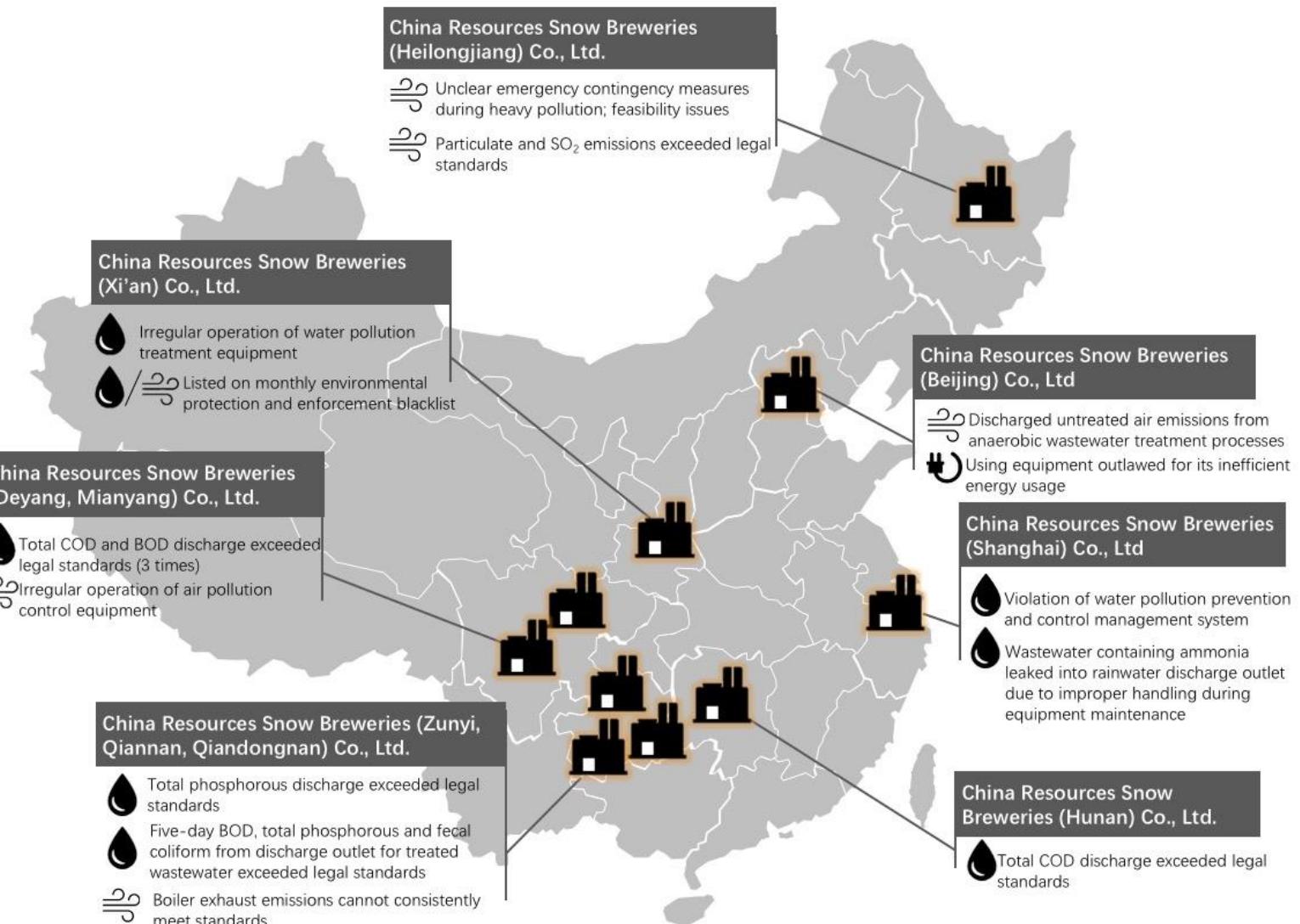


Table 5. Environmental Supervision Records at CR Snow Subsidiaries (2014 – 2017)
(Data Source: Blue Map Database)



- 62 breweries in China
- 3 factories with air emissions violations
- 4 factories with wastewater violations
- 7 factories with procedural violations
- 1 factory with an energy efficiency violation

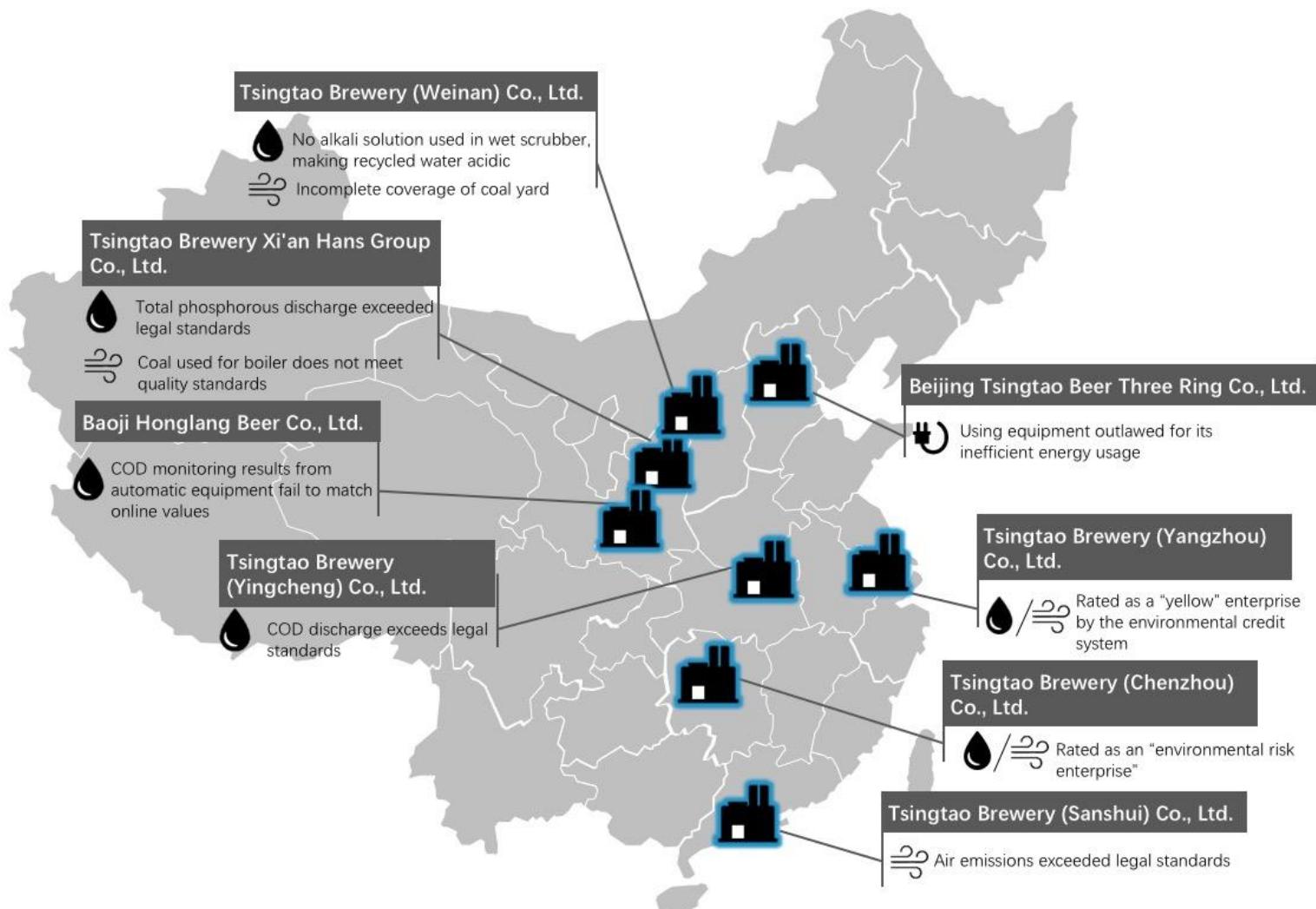


Table 6. Environmental Supervision Records at Tsingtao Beer Subsidiaries (2014 – 2017)
(Data Source: Blue Map Database)



- 41 breweries in China**
- 9 factories with air emissions violations**
- 3 factories with wastewater violations**
- 2 factories with procedural violations**

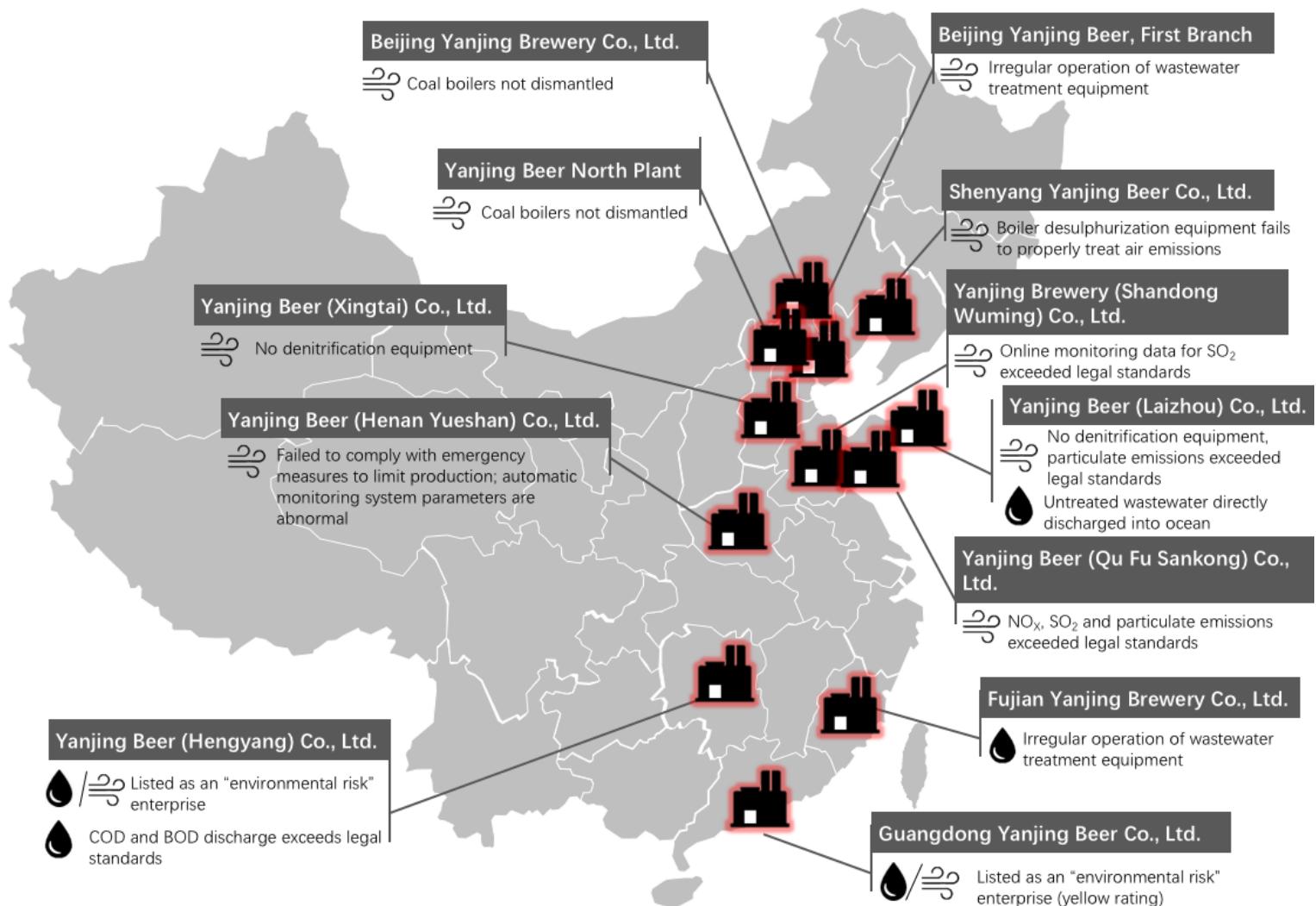


Table 7. Environmental Supervision Records at Yanjing Beer Subsidiaries (2014 – 2017)
(Data Source: Blue Map Database)



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Pollution from Beer Bottle Production Rivals that of Iron & Steel and Cement Industries

According to current national economic industrial classification standards, glass beer bottle manufacturing falls under the daily-use glass manufacturing industry. As shown in Figure 8, after raw materials such as sand, limestone, soda ash, and slag from old glass bottles are crushed and mixed, they are then melted in kilns that reach temperatures as high as 1400 degrees. After the glass slag has been pressed and molded, it is then annealed, processed and inspected to finally produce glass bottles.

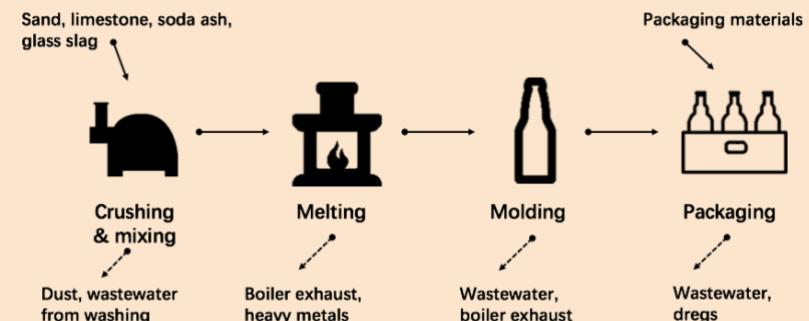


Figure 8. Manufacturing Process and Inputs & Outputs for New Beer Bottles

Similar to iron & steel, cement, thermal power and other such industries, daily-use glass manufacturing is also a major contributing source to air pollution. Main air pollutants include the following: dust generated during raw materials transportation, storage and processing; particulates emitted by kilns during melting processes; sulfur dioxide (SO_2); and nitrogen oxide (NO_x).

Since the melting processes need to be performed at a temperature as high as around 1400 degrees Celsius, glass bottle manufacturing processes

consume a significant amount of fuel. For cost considerations, some small- and medium-sized enterprises prefer to use low-cost fuels such as coal, heavy oil or even high-sulfur petroleum coke.²⁰ 2015 statistics on the discharge of pollutants from the daily-use glass manufacturing industry show that glass furnaces using producer gas account for 50% of the total furnace volume in the industry.²¹ The calorific value of the furnace gas is low, and the state of combustion is difficult to control. Coal transport and storage processes also generate dust, and coal combustion generates particulates, NO_x and SO₂.

According to data from the China Industry Development Research Network, China produced 52.2 billion glass beer bottles in 2015.²² When pollution for glass beer bottle manufacturing is calculated based on the Pollutant Discharge Standards for the Daily-Use Glass Manufacturing Industry (Second Draft for Feedback), manufacturing 52.2 billion glass beer equates to producing 15,000 tons of particulates, 94,000 tons of NO_x, and 88,000 tons of SO_x.

Apart from wastewater and air emissions, an analysis by Heineken²³ and Carlsberg²⁴ on the carbon footprint of beer production shows that when compared to barley cultivation, malt production, beer brewing, logistics, and retail refrigeration, the packaging production processes for beer produce the largest amount of greenhouse gas emissions. In a life cycle analysis of regular lager beer, Talve (2001) found that within the entire value chain from production to consumption, the contribution to climate change from packaging was the greatest.²⁵ As a result, to achieve compliance, promoting energy conservation and emissions reduction from beer packaging will raise the efficiency and reduce the carbon footprint of the beer supply chain.

Environmental Performance of Big Brands' Suspected Bottle Manufacturers is Unsatisfactory

An environmental compliance screening conducted on 81 glass beer bottle manufacturers (including those on the list of beer bottle quality inspection results published by the General Administration of Quality Supervision, Inspection and Quarantine in 2012)²⁶ found that 35 of these enterprises have

been subject to environmental violations since 2014. Among these factories, over 71% of environmental supervision records were issued for reasons relating to air emissions (see Figure 9), including for such issues as SO₂, NO_x, and particulate emissions exceeding legal standards, irregular operation or idling of air pollution treatment equipment, and construction of monitoring equipment out of accordance with standards.

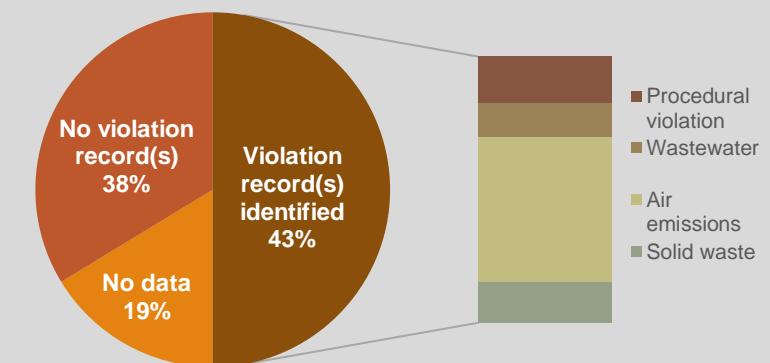


Figure 9. Statistics on Environmental Violations for Glass Beer Bottle Manufacturers
(Data Source: Blue Map Database)

It is worth mentioning that many large-scale daily-glass manufacturers are suspected bottle suppliers to the top-five beer brands (see Figure 10 & Table 2). Among these companies, AB InBev's suspected supplier, Yamamura Glass Qinhuangdao Co., Ltd.,²⁷ was fined 12.47 million RMB in April 2016 for refusing to correct such problems as its air emissions exceeding pollutant standards and not obtaining a permit for its air emissions²⁸.

A suspected supplier to Tsingtao Beer, Yanjing Beer, and CR Snow – Guilin Jingsheng Glass Co., Ltd.²⁹ – was fined 80,000 RMB for its January 2015 particulates air emissions exceeding the level 2 limits³⁰ in the Emissions Standard of Air Pollutants for Industrial Kiln and Furnace.

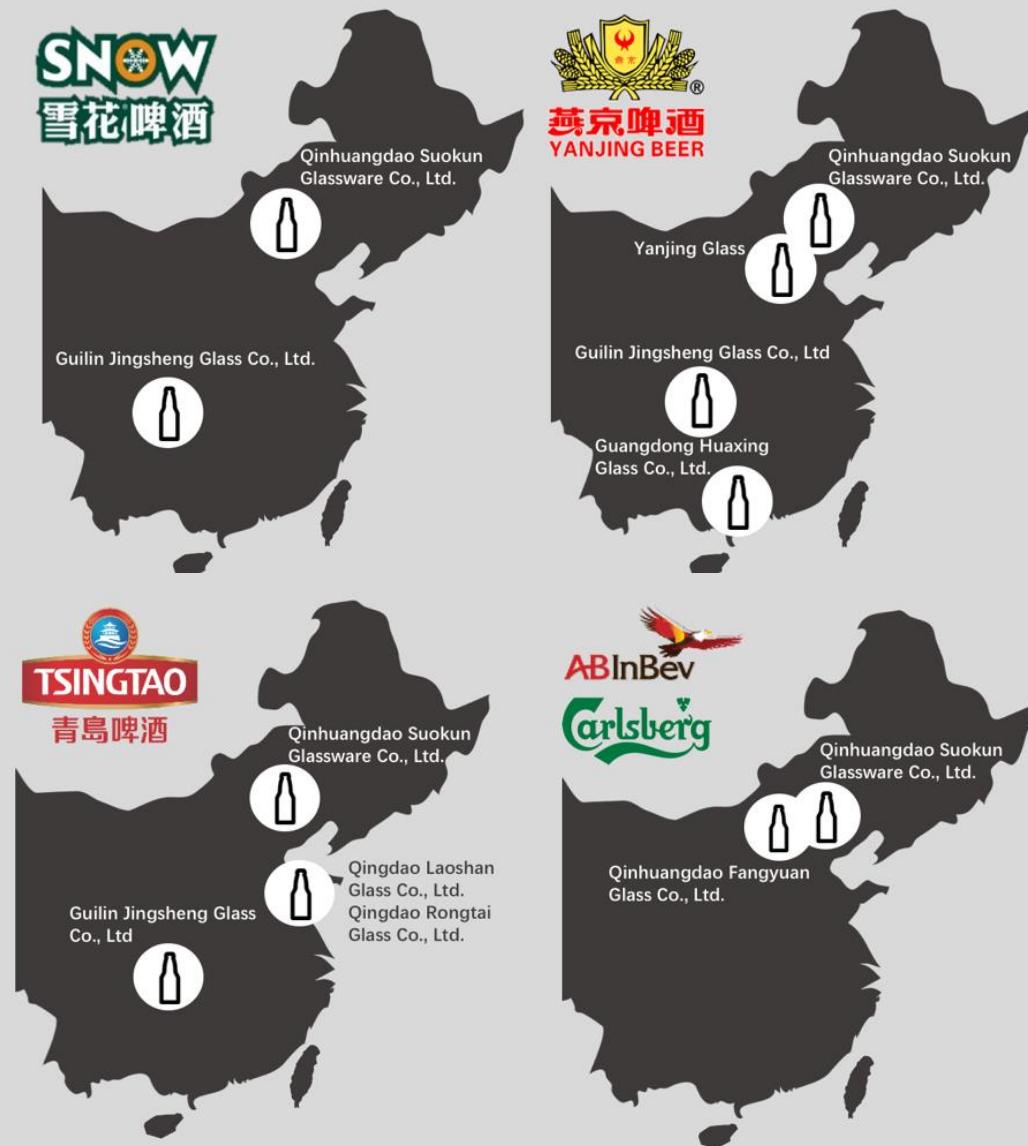


Figure 10. Glass Bottle Manufacturers with Environmental Violation Records Suspected of Supplying to Beer Brands
(Data Source: Blue Map Database)

Table 2. Environmental Supervision Records at Suspected Suppliers to Major Beer Brands

Enterprise Name	Customer Brand(s)	Environmental Supervision Record
Hebei Yanjing Glass Products Co., Ltd. ³¹	Yanjing Beer ³²	2016: Unauthorized stoppage of air pollution control equipment; illegal discharge of pollutants; 2015: Discharged pollutants in excess of annual total limits for key pollutants.
Yamamura Glass Qinhuangdao Co., Ltd. ³³	AB InBev ³⁴	March 2017: Total NO _x discharge from kiln exceeded legal standard; November 2016: Several days' online monitoring data exceeded legal standards; April 2016: Refused to implement rectifications for air pollutant emissions exceeding legal standards, and did not obtain emissions permit and discharge air pollutants according to law. January 2016: SO ₂ , NO _x and particulate emissions all exceeded legal standards.
Qinhuangdao Suokun Daily Glassware Group Co., Ltd. ³⁵	Yanjing Beer, CR Snow, AB InBev, Xuejin Beer, Pabst Blue Ribbon, Harbin Beer ³⁶	January 2016: Particulate, SO ₂ and NO _x emissions all exceeded legal standards; October 2015: Particulate, SO ₂ and NO _x emissions all exceeded legal standards; September 2015: NO _x emissions for north plant kilns no. 3 and 4 exceeded legal standards; emissions for particulates, SO ₂ and NO _x exceeded legal standards at all kiln outlets.
Guangdong Huaxing Glass Co., Ltd. ³⁷	Yanjing Beer, AB InBev, Pearl River ³⁸	Hebei Huaxing Glass Co., Ltd., February 2017: Listed as a “problem enterprise” by Air Quality Special Investigative Work. ³⁹ Henan Huaxing Glass Co., Ltd., 2017: Desulphurization and dust scrubbers did not add alkaline absorbing agent as required, resulting in highly acidic spraying solution; discharge outlets for quartz, glass slag and other used materials did not install dust collection and dust removal equipment based on the requirements of the environmental impact assessment (EIA); did not limit production by 30% as required while the “orange” emergency warning for Zhengzhou was still in effect; 2016: Total SO ₂ emissions exceeded legal standards on many occasions; rectifications have already been completed; ⁴⁰ 2014: Fugitive emissions of smoke and particulates during construction processes. ⁴¹
Qingdao Laoshan Glass Co., Ltd. ⁴²	Tsingtao Beer ⁴³	June-July 2017: Glass furnace SO ₂ (June, July), NO _x (June) and particulate (July) emissions exceeded legal standards; November 2016: Glass furnace NO _x emissions exceeded legal standards; November 2016: Monitoring stations and sampling monitoring platforms were not set up in accordance with regulations and monitoring specifications; March – October 2015: SO ₂ and NO _x emissions exceeded legal standards on multiple occasions.
Qingdao Rongtai Glass Products Co., Ltd. ⁴⁴	Tsingtao Beer ⁴⁵	September 2016: Online monitoring data showed NO _x emissions in excess of legal standard; January 2016: Air emissions exceeded legal standards.
Guilin Jingsheng Glass Co., Ltd. ⁴⁶	Tsingtao Beer, Yanjing Beer, CR Snow ⁴⁷	2016: Began construction before approval was obtained; 2015: Particulate emissions from kiln exceeded the level 2 limits stipulated in the “Emission standard of air pollutants for industrial kiln and furnace.”

(Data Source: Blue Map Database)

Long-term Plan: Establish a Recycling System for Glass Bottles

Glass packaging can be reused, but the current rate of recycling for used glass in China is only 13% to 15%, which falls far below the EU average of 90% reuse.⁴⁸ Among key contributing factors to this situation are a lack of recycling mechanisms and supporting infrastructure.

For these reasons, we recommend to extend the use of Germany's Pfand recycling model; namely, include a beer bottle deposit in the price of the product. When the consumer returns the old bottle to the retailer, the deposit can be retrieved. The beer manufacturer is then responsible for taking the used bottles back to the factory for reuse. The deposits for bottles are determined based on each category. For example, the recycling price for each glass beer bottle is 0.08 euros, and 0.15 euros for each plastic bottle. In addition, the body of each bottle that can be recycled using the Pfand system is marked with a special label for easy identification by recycling machines. This model has been widely promoted in Germany, reducing the production of new bottles and at the same time cutting the energy consumption and secondary pollution caused by waste treatment.⁴⁹

Research findings show that adding used glass bottles to kilns can reduce the temperature required for melting and extend the life of the furnace. Every 10% increase in the amount of used glass bottles can lead to energy savings of 2% to 3%.⁵⁰ Therefore, establishing a beer bottle recycling mechanism and improving the recycling rate of used bottles can not only help enterprises save fuel costs and reduce equipment maintenance and renovation costs, but can also reduce the overall production of glass bottles, thereby shrinking the environmental load of the entire beer production chain.



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Beer Industry Needs to Implement Green Supply Chain

In order to promote beer brands to focus on the environmental violations of their subsidiaries and suppliers, we twice sent letters to CR Snow, Tsingtao Beer, Yanjing Beer, AB InBev, and Carlsberg at the end of 2017 and the beginning of 2018. We hope these five major brands could push their problem suppliers to issue public explanations about the reasons for their environmental violations and corrective measures adopted to address them. Up through March 2018, we had received initial explanations via a call from Yanjing Beer and a single response e-mail from Tsingtao Beer.

Major beer brands generally disregard the environmental compliance of their suppliers in China, leading the beer industry to collectively score low on the Corporate Information Transparency Index (CITI), falling far behind the IT and textile & apparel industries. This situation contrasts sharply with multiple beer brands' publicity of their efforts in energy conservation and cleaner production, as well as the green image that they cultivate.

The beer consumption market is currently undergoing profound changes. In order to gain a leading position in the new round of high-end market competition and the current wave of green consumption, big brands must urgently improve the environmental performance of their beer production supply chain, and use green supply chain to provide the public with green products. We hence raise the following recommendations to big beer brands:

- 1.** Push subsidiary factories – especially breweries – to attain environmental compliance;
- 2.** Implement green supply chain, and use IT methods to control the environmental compliance risks from manufacturing new beer bottles;
- 3.** Consolidate production resources, eliminate old equipment that is highly polluting or uses high amounts of energy, and transition toward low-energy, low-carbon, and high-efficiency sustainable development models;
- 4.** Improve the disclosure of environmental information, and communicate to the public about how the brand manages the environmental impacts of beer production throughout the entire life cycle.



Appendix

**Table 1. Summary of Environmental Violation Records for China Resources Snow Breweries' Subsidiaries
(Procedural violations not included)**

Subsidiary	Time of Penalty	Environmental violation
China Resources Snow Breweries (Shanghai) Co., Ltd.⁵¹	September 2017	Violation of water pollution prevention and control management system
	December 2016	Wastewater containing ammonia leaked into the rainwater discharge outlet due to improper handling during equipment maintenance
China Resources Snow Breweries (Mianyang) Co., Ltd.⁵²	April 2017	BOD discharge exceeded legal standards by 4 times COD discharge exceeded legal standards by 3.7 times
	January 2017	COD discharge exceeded legal standards by 1.7 times
	November 2016	COD discharge exceeded legal standards by 4.2 times
China Resources Snow Breweries (Xi'an) Co., Ltd.^{53 54}	July 2015	Irregular operation of water pollution treatment equipment
	May 2015	Listed on monthly environmental protection and enforcement blacklist
China Resources Snow Breweries (Beijing) Co., Ltd.⁵⁵	April 2017	Discharged untreated air emissions from anaerobic wastewater treatment processes
	December 2016 – April 2017	Using equipment outlawed for its inefficient energy usage
	March 2014	Unstable operation of automatic monitoring equipment, resulting in inaccurate monitoring data
China Resources Snow Breweries (Heilongjiang) Co., Ltd.⁵⁶	April 2017	Unclear emergency contingency measures during heavy pollution; feasibility issues
	October 2015	According to the daily average value of online historical monitoring data, particulate and SO ₂ emissions exceeded legal standards for most of October
China Resources Snow Breweries (Qiandongnan) Co., Ltd.⁵⁷	March 2015	Five-day BOD, total phosphorus concentration and fecal coliform from discharge outlet for treated wastewater exceeded standard limits
China Resources Snow Breweries (Zunyi) Co., Ltd.⁵⁸	February 2015	Total phosphorus concentration from main discharge outlet exceeded standards by 0.33 times
China Resources Snow Breweries (Deyang) Co., Ltd.⁵⁹	First half of 2014	Irregular operation of air pollution control equipment
China Resources Snow Breweries (Hunan) Co., Ltd.⁶⁰	2 nd quarter 2014	BOD discharge exceeded legal standards
China Resources Snow Breweries (Qiannan) Co., Ltd.⁶¹	July 2014	Factory causes severe environmental pollution or its pollutant discharge cannot consistently meet standards; required to implement rectifications to boiler before deadline

(Data Source: Blue Map Database)

**Table 2. Summary of Environmental Violation Records for Tsingtao Beer's Subsidiaries
(Procedural violations not included)**

Subsidiary	Time of Penalty	Environmental Violation
Tsingtao Brewery Xi'an Hans Group Co., Ltd.⁶²	October 2016	Coal used for No.3 boiler contains 16.99% coal ash, exceeding legal limits by 15%
	November 2014	Total phosphorus discharge exceeded legal standards by 2.5 times
Beijing Tsingtao Beer Three Ring Co., Ltd.⁶³	November 2016 - March 2017	Using equipment outlawed for its inefficient energy usage
Tsingtao Brewery (Chenzhou) Co., Ltd.⁶⁴	2015	Rated as an "environmental risk enterprise"
Tsingtao Brewery (Sanshui) Co., Ltd.⁶⁵	April 2014	Air emissions exceeded legal standards
Tsingtao Brewery (Weinan) Co., Ltd.⁶⁶	February 2015	On-site investigation finds no alkali solution used in wet scrubber, making recycled water acidic; incomplete coverage of coal yard
Baoji Honglang Beer Co., Ltd. (formerly Tsingtao Brewery (Baoji) Co., Ltd.)⁶⁷	March 2014	COD monitoring results from automatic equipment failed to match online values
Tsingtao Brewery (Yingcheng) Co., Ltd.⁶⁸	April 2014	COD discharge exceeded legal standards
Tsingtao Brewery (Yangzhou) Co., Ltd.	2016	Rated as a "yellow" enterprise by the environmental credit system

(Data Source: Blue Map Database)

**Table 3. Summary of Environmental Violation Records for Yanjing Beer's Subsidiaries
(Procedural violations not included)**

Subsidiary	Time of Penalty	Environmental Violation
Yanjing Beer (Qu Fu Sankong) Co., Ltd.⁶⁹	January – April 2017	No denitrification equipment; NOx, SO ₂ and particulate emissions exceeded legal standards
	2016	No denitrification equipment; NOx, SO ₂ and particulate emissions exceeded legal standards
	March - December 2015	No denitrification equipment; NOx, SO ₂ and particulate emissions exceeded legal standards
Yanjing Brewery (Shandong Wuming) Co., Ltd.⁷⁰	June 2015	Online monitoring data for SO ₂ exceeded legal standards
	March - September, November- December 2015	NO _x , SO ₂ and particulate emissions exceeded legal standards
Yanjing Beer (Xingtai) Co., Ltd.⁷¹	February 2017	No denitrification equipment
	August 2016	Unauthorized changes to production processes; failed to re-apply for environmental assessment procedures
Yanjing Beer (Henan Yueshan) Co., Ltd.⁷²	April 2017	Failed to comply with the emergency plan to limit production; automatic monitoring system parameters are abnormal
Beijing Yanjing Brewery Co., Ltd.⁷³	April 2017	There are still 9 coal-fired boilers at the factory, out of which 3 are in use, 3 are spares, and 3 lay idle but are not yet dismantled
Fujian Yanjing Brewery Co., Ltd.⁷⁴	September 2016	Irregular operation of wastewater treatment equipment
Yanjing Beer (Laizhou) Co., Ltd.⁷⁵	September 2017	Particulate emissions exceeded legal standards
	August 2017	Particulate emissions exceeded legal standards
	January - August 2016	No denitrification equipment, particulate emissions exceeded legal standards
	September 2016	Some untreated wastewater generated from the brewing workshop and all wastewater from draught beer workshop directly discharged into ocean
	January – March May – December 2015	No denitrification equipment, particulate emissions exceeded legal standards
	November-December 2014	No denitrification equipment, particulate emissions exceeded legal standards
Yanjing Beer (Hengyang) Co., Ltd.	2014, 2015	Rated as an “environmental risk enterprise” ⁷⁶
	2 nd and 3 rd quarters of 2014	Data for 2 nd quarter of 2014 shows BOD discharge exceeded legal standards Data for 3 rd quarter of 2014 shows COD discharge exceeded legal standards
Guangdong Yanjing Beer Co., Ltd.	2014	Rated as an “environmental risk enterprise” (yellow rating) ⁷⁷
Shenyang Yanjing Beer Co., Ltd.	December 2015	“Boiler desulphurization equipment fails to add enough treatment solution, equating to irregular use of air emissions treatment equipment” ⁷⁸
Beijing Yanjing Beer	February	Pollutant monitoring equipment for No. 2 smokestack

Co., Ltd., First Brunch	2014	failed; company “failed to report it in accordance with regulations and did not repair the equipment in time.” coal-fired boiler “flues have aged, several pipe joints are broken and causing leakage, and records of adding alkali solution are imperfect, equating to irregular operation of air emissions treatment equipment” ⁷⁹
Yanjing Brewery North Plant	February 2014	“Boiler flue is not tightly sealed, resulting in exhaust leakage” ⁸⁰

(Data Source: Blue Map Database)

**Table 4. Summary of Environmental Violation Records of Anheuser-Busch InBev's Subsidiaries
(Procedural violations not included)**

Subsidiary	Time of Penalty	Environmental Violation
Anheuser-Busch InBev Harbin Brewery Co., Ltd. ⁸¹	2015	COD discharge exceeded legal standards
Anheuser-Busch InBev Zhoushan Brewery Co., Ltd. ⁸²	July 2015	Ammoniacal nitrogen in wastewater exceeded legal standards by 0.5 times
Anheuser-Busch InBev Sedrin Brewery Co., Ltd. No.2 Factory ⁸³	February 2014	COD monitoring results from automatic equipment failed to match online values
Anheuser-Busch InBev Ningbo Brewery Co., Ltd. ⁸⁴	October 2014	Discharged pollutants through channels other than designated discharge outlet
InBev Jinlongquan Brewery (Xiaogan) Brewery Co., Ltd. ⁸⁵	November 2016	Failed to dismantle coal-fired boilers as required
Henan Xinxiang Asia Brewery Co., Ltd. ⁸⁶	January 2016	COD concentration reached 263mg/L, exceeding the legal standard (150mg/L) by 0.75 times

(Data Source: Blue Map Database)

Table 5. Summary of Environmental Violation Records of Carlsberg Beer's Subsidiaries
(Procedural violations not included)

Subsidiary	Time of Penalty	Environmental Violation
Carlsberg Beer (Guangdong) Co., Ltd. ⁸⁷	October 2014	Excessive discharge of pollutants; failed to implement rectifications by deadline
Chongqing Brewery Co., Ltd. (Mawangxiang) ⁸⁸	January – March 2015	Odor pollution, excessive noise pollution
Xinjiang Wusu Beer Co., Ltd. ⁸⁹	December 2015	Total phosphorus from No. 1 discharge outlet exceeded legal standards by 0.6 times

(Data Source: Blue Map Database)

Footnotes

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