

End of Life Vehicle Regulation in South Korea Research and Response Strategy

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Abstract: In April 2007, the Ministry of Environment of South Korea issued the "Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles", which stipulates the requirements of electronic and electrical products and automotive products in terms of hazardous substances, recovery rates, polymer material marking, and information disclosure of end of life vehicles. There are mandatory controlling requirements for M1 and N1 automobile products put into the Korean market. In view of the multiple amendments to the regulations, this paper will solve and analyze the act, and focus on the overall management system framework of hazardous substances and recycling and related technical requirements in South Korea, and analyze the differences in the management of hazardous substances and recycling rates among South Korea and China and the European Union. Finally, this paper summarizes the key points of response strategies for Chinese automobile manufacturers when they want to export their vehicles to the Korean market.

1. Introduction

In recent years, the comprehensive utilization of automobile resources has aroused widespread concern in the industry. On one hand, under the carbon neutrality Goal, domestic automobiles in China continue to pursue the green and low-carbon circular development of automobiles. On the other hand, domestic automobile companies in China speed up the pace of going out, in the international hazardous substances and recycling (ELV) under the strict requirements, exports will face the invisible green threshold. As a representative automobile developed country in Asia, South Korea's automobile industry has developed rapidly since its start in the 1960s. And from the data of the China Automobile Circulation Association in 2022, it was found that the export volume of South Korea in 2021 climbed from more than 6,000 in 2020 to 13,000, achieving a new breakthrough of doubling, but there are relatively few research literatures on the specific response to hazardous substances and recovery rates of South Korean automobiles, and it is necessary to analyze the management requirements and practical operation of ELV in South Korea. To provide guidance to vehicle manufacturers that have export needs in Korea.

2. Introduction to South Korea's ELV Regulatory System

South Korea began legislative research on hazardous substances in 2004, started the drafting of the bill and the collection of industry opinions in 2005, and issued the "Electronic and Electrical products and automobile resource recycling Law" on April 27, 2007 (referred to as the "recycling Act"), which was implemented on January 1, 2008. The "Recycling Act" is the first special law and regulation for the recycling of electronic, electrical and automotive products in South Korea [1], which mainly covers two categories of electronic, electrical and automotive products. It covers the requirements of the European Union's RoHS Directive on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment, WEEE Directive on Waste Electrical and Electronic Equipment and ELV Directive on Waste Vehicles, and other three directives. As an important constraint object of regulatory requirements, automotive products must strictly comply with the relevant requirements. Since the release of the "recycling program", after continuous revision, On August 16, 2023, the Ministry of Environment of South Korea issued document No. 19665 as the competent authority, that is, the latest version of the act on Resource Recycling of Electronic, Electrical and Automotive Products.

In order to implement the "Recycling Act", the Ministry of Environment of South Korea has successively promulgated the "Enforcement Order on Resource Recycling of Electronic and Electrical Products and Automobiles" (hereinafter referred to as the "Enforcement Order"), the "Implementation Rules on Resource Recycling of Electronic and Electrical Products and Automobiles" (hereinafter referred to as the "Implementation Rules") and the "Guidelines on the treatment of Hazardous Substances Compliance and other related businesses of Electronic and Electrical Products and Automobiles" (hereinafter referred to as: Business Guidelines), the relevant supporting rules and regulations are an important guarantee for effective ELV management in Korea.

3. South Korean ELV Management Model

Table 1: The subject of obligation performance and its role in each stage of automotive ELV

Stage	obligation performance of subject	Role
precaution	Vehicle manufacturers, importers	Fulfill the obligation of prevention - The obligation to comply with hazardous substance content standards and to publish compliance, achieve annual recovery rates and provide recovery information (including material marking and dismantling manuals)
End of life vehicle recycling	Vehicle manufacturers, importers	Recycling technical support - Comply with the recycling rate of used vehicles, and provide technical support for the development of used vehicle recycling technology
	Vehicle disassembly recycler	Dismantle - Comply with vehicle recycling rates to maximize recovery of end-of-life vehicles - The remaining scrapped cars after recycling are handed over to the shredding enterprises
	Shredding companies	Shredding- Comply with vehicle recycling rates to maximize recovery and deliver recyclable pulverized residue to ASR companies
	ASR companies	Recycling of shredding residue residues Energy is recovered from the residue of the crushing residue
	Waste gas companies	Exhaust gas treatment, recovery or safe treatment of material gases containing changes in the climate and ecological system
	related organization	The agent submits the recycling result - Agent to submit waste car recycling results (only for corporate users) - If an individual has a recycling facility (the individual is registered as a recycling business), the end-of-life car is recycled

Under the requirements of the ELV regulatory system, South Korea has gradually formed a management model of "self-declaration + Back-end regulatory validation". And take the "front-end to formulate preventive provisions + back-end actual end of life vehicle recycling verification" way, its direct responsibility for the main body of South Korean manufacturers, South Korean importers and South Korean recycling scrap dismantling enterprises. Domestic automobile companies, as manufacturers outside Korea, export their products to Korea as importers, which indirectly need to fulfill relevant information transmission obligations. Specific obligations and roles are shown in Table 1.

3.1 Front-end Management

3.1.1 ELV Self-declaration

The act requires automobile importers to complete the self-declaration of ELV materials in the EcoAS system within 3 months from the date of import declaration. The self-declaration includes: the basic information of the self-declared enterprise, the basic information of the product, and the conformity declaration of the hazardous substances and the recovery rate of the product.

In addition, the act requires recycling information to be provided by the vehicle manufacturer/importer within six months from the date of shipment or import in any of the following ways.

(1) Release recovery information in the Operation management information System EcoAS (full name: Eco-Assurance System of Electrical and Electronic Equipment and Vehicles).

(2) Publish recycling information on websites operated and managed by manufacturers/importers of electrical/electronic products or automobile manufacturers/importers. In this case, the head of the EcoAS institution shall be notified.

The disassembly information provided should include: product name, year of release, model name, and disassembly procedure.

3.1.2 Introduction to EcoAS System

The EcoAS system is led by the Ministry of Environment of South Korea, in order to promote the recycling of electrical and electronic products and automobiles, by establishing a resource recycling system, limiting the use of harmful substances, making it easy to recycle, and properly recycling waste, so as to promote environmental protection and the healthy development of the national economy. The EcoAS system is a preventive policy that aims to reduce the burden of environmental pollution by systematically managing the whole process from the design and production stages to the end-of-life stage of the vehicle.

3.2 Back-end Supervision

3.2.1 Consistency Audit

Give priority to the inspection of manufacturers and importers of products with high market share and high sales volume, and establish corresponding random inspection frequency and mechanism principles. Consistency Audit process is shown in Figure 1.

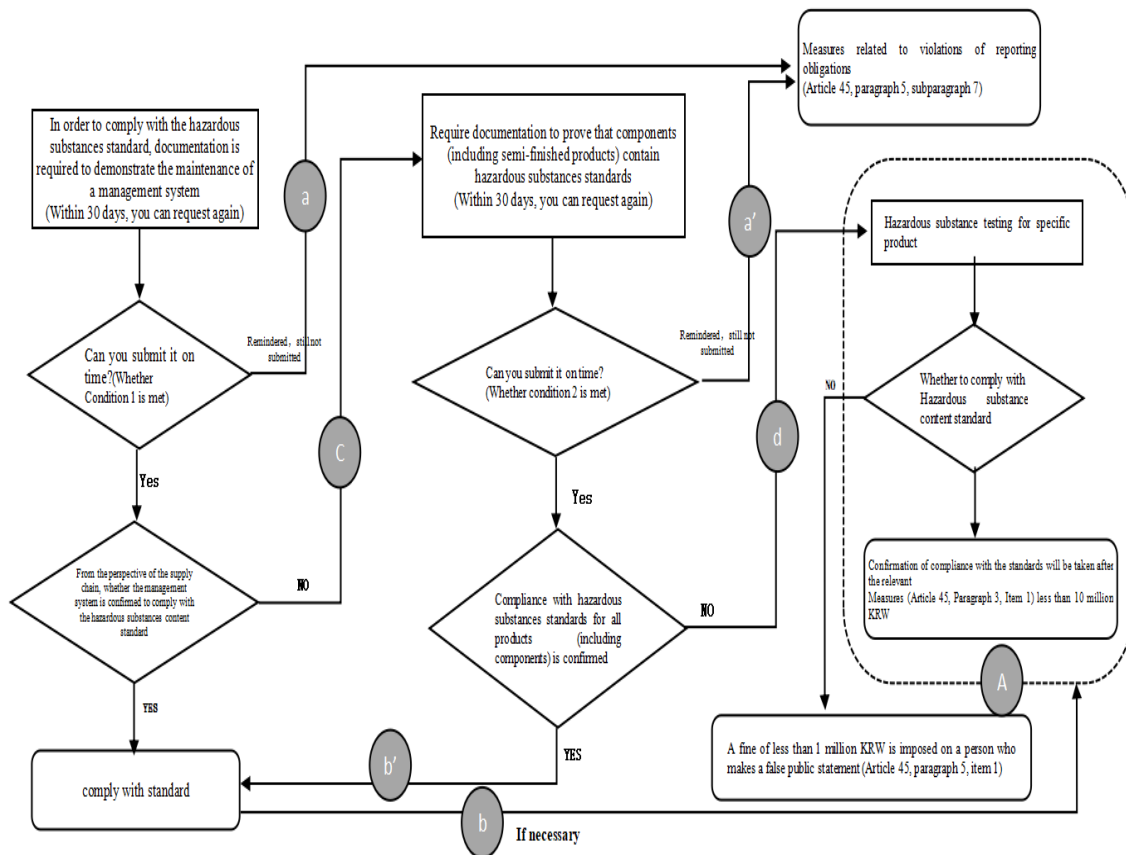


Figure 1: Flow chart of compliance review for hazardous substances [5]

Process a: The submission of management system documents is as follows:

(1) Profile document

1) It mainly includes the telephone number, address and email address of the responsible contact person of the relevant departments of the enterprise, etc., for the communication of consistency review and confirmation.

2) Company profile: including the company's introduction and development, e.g. organization and composition (factory name, industry, production products, number of employees, business division of labor, etc.)

3) Response strategy: A brief description of the standard management system for compliance with hazardous substance content

4) Instructions for the use of the internal data system, which contains the internal data system for the compliance analysis of hazardous substances

Process b: If proof of compliance with hazardous substance standards is provided, relevant testing will be carried out only if necessary.

Process c: If the management system is being built or is not running, proceed to the next step. Validation of downstream supply chains

Process a': Provide relevant documentation of the management system

Process A: Additional materials or necessary on-site confirmations

3.2.2 Test Requirements

Products that are judged to have a high rate of violations or violations that have a greater impact on the environment are selected according to the following principles: high market share, known to

contain a large number of hazardous substances, high sales volume, short life span, difficult to recycle, difficult to identify through ngos or related industries, and products that violate relevant foreign laws and regulations.

(1) The test shall disassemble the parts into homogeneous materials, and the test report with mixed components shall not be accepted;

(2) In order to ensure the professionalism of the tester and the reliability of the results, the test should be carried out in the corresponding qualified laboratory.

4. Technical Requirements for Automotive Products

The "Recycling Act" has two provisions for automobile products: (1) front-end preventive provisions, aiming at taking measures at the front end of the industrial chain to prevent environmental pollution, targeting automobile manufacturers and importers; (2) End provisions: The purpose is to specify the responsibilities of all parties, so as to improve the actual recycling and utilization rate of end of life vehicles. The targets are scrapped vehicle recycling and dismantling enterprises, automobile production enterprises and import enterprises [2].

The act mainly stipulated technical requirements for automotive products from the aspects of "model application scope", "hazardous substance management scope", "hazardous substance exemption", "recovery rate requirements", "material marking requirements" and "disassembly recycling requirements".

4.1 Scope of Use

Automobile products in accordance with the requirements of Article 3 (1) of the Motor Vehicle Administration Law, the following two categories of vehicles belong to the scope of control: passenger vehicles with seats not exceeding nine, including the driver's seat, namely: M1 passenger vehicles; Light/small commercial vehicles, i.e. N1 commercial vehicles.

4.2 Scope of Hazardous Substances Management

Article 9 of the Recycling Act clearly states that "in order to facilitate the recycling of electronic and electrical products and automotive resources and minimize the harm to the environment, in the products used in daily life and in circulation, the" enforcement Order "stipulates that automobile manufacturers and importers must comply with the content standard of hazardous substances, that is, heavy metals that are highly harmful to the environment. This does not apply, however, if the nature of the product makes it impossible to remove the hazardous substance, or if it is identified as having no alternative, and if it is intended for research, development or export [3, 4].

In addition to the exemption option, four heavy metals, lead (Pb), cadmium (Cd), hexavalent chromium (Cr⁶⁺) and mercury (Hg), are included in the management. Content limits of hazardous substances is shown in Table 2, and exemptions for hazardous substances is shown in Table 3.

Table 2: Content limits of hazardous substances in homogeneous materials

Scope	Hazardous substances	Limit value(wt)
Automobiles and their parts	Pb	0.1%
	Hg	0.1%
	Cr ⁶⁺	0.1%
	Cd	0.01%

Table 3: List of exemptions for hazardous substances

No	Exempt materials and parts	Scope and expiry date of the exemption
Pb		
1. Lead as an alloying element		
1.1 Steel for machining purposes		
1)	Steel for machining purposes and galvanised steel components containing up to 0,35 % lead by weight	long-term
2)	Non-continuously galvanised steel sheet containing up to 0,35 % lead by weight	long-term
1.2 Aluminium material (lead=<0.4%)		
1.4 Copper alloy (lead=<0.4%)		
2. Lead and lead compounds in components		
2.8 Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)		long-term
2.10 Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages		long-term
2.11 Lead in solder to attach heat spreaders to the heat sink in power semiconductor assemblies with a chip size of at least 1 cm ² of projection area and a nominal current density of at least 1 A/mm ² of silicon chip area		
2.13 Lead in the welding of glass used in welding		
The following sections contain lead in electrical and electronic products. However, it does not include lead contained in glass for light bulbs, glazes for ignition, or (or) to (or) ceramic parts of genetic bodies		
(1) Glass or ceramic		long-term
(2) Glass-based compounds or ceramic pad based compounds		long-term
(3) glass-ceramic material		long-term
(4) Glass-ceramic matrix compounds		long-term
2.14 Lead contained in zircon titanate, a genetic ceramic substance used in batteries as part of integrated circuits or independent semiconductors		long-term
hexavalent chromium		
Hexavalent chromium used as a preservative in absorption carbon steel cooling systems, not more than 0.75% by weight in the cooling solution:		long-term

Note: The above does not include waivers that have expired.

4.3 Recovery Rate Requirements

For vehicles after January 1, 2010, the recovery rate is not less than 95%, of which energy recovery is not less than 10%. Article 23 of the "presidential decree" requires: 1) From January 1, 2009 to December 31, 2014, the recovery rate per unit weight of ≥85%, of which energy recovery shall not be higher than 5%. 2) From January 1, 2015, the recycling rate per unit weight shall be ≥95%, of which the energy recovery shall not be higher than 10%.

The specific calculation formula for the recovery rate is as follows:

$$Rcov = \frac{mP+mD+mM+mTr+mTe}{mV} \times 100\% \quad (1)$$

Rcov: recyclable utilization rate;

mp: Material quality considered in the pretreatment stage;

mD: Material quality considered during the dismantling stage;

mM: The quality of the metal considered in the metal separation stage;

mTr: The quality of materials that are considered reusable at the non-metallic residue treatment stage;

mTe: The mass of the material considered to be energy recoverable at the non-metallic residue treatment stage; mv: Vehicle quality.

4.4 Requirements for Material Identification

For the material > 100g plastic and > 200g rubber parts need to be marked in accordance with the corresponding requirements.

4.5 Requirements for Dismantling and Recycling

The Act requires the production of corresponding dismantling manuals/procedures for automotive products to guide the dismantling enterprises to carry out the recycling of automotive products.

5. South Korea versus China and the European Union

Based on the Korea act requirements, see the Comparison of ELV management model among South Korea, China and the European Union in Table 4.

Table 4: Comparison of ELV management

comparative item	South Korea	China	EU
management level	Law	Administrative document	directive
management mode	Self-declaration + Enforcement	Self-declaration + consistency verification	RRR Certification + Enforcement
Controlled vehicle type	M1,N1	M1	M1,N1
Controlled substance	Pb,Cd,Hg,Cr ⁶⁺	Pb,Cd,Hg,Cr ⁶⁺ ,PBBs,PBDEs	Pb,Cd,Hg,Cr ⁶⁺
Recovery target	≥85% ≥95%	≥85% ≥95%	≥85% ≥95%
Actual Recovery target	YES	NO	YES
penalty	Economic penalty + administrative penalty	There is no clear penalty	Economic penalty + administrative penalty

6. Key Points of Strategies of Korean ELV

For South Korea's hazardous substances and recovery requirements, from the perspective of South Korea's overseas manufacturers, we need to grasp the following points:

(1) Confirm importer information and divide responsibilities.

South Korean importers are the first responsible party for ELV responsibilities, and Chinese manufacturers need to confirm the responsibilities of both sides with the corresponding importers before exporting to South Korea to do a good job of product compliance.

(2) The manufacturer confirms the establishment and operation of the internal ELV management system.

Manufacturers should establish an internal ELV management system in accordance with the requirements of Korean laws and regulations, and conduct internal periodic audits for the established system to ensure that the system runs smoothly.

(3) Pay attention to the dynamic update of regulations, especially the update of exemption options.

ELV regulations will be revised in a timely manner with policy changes. Manufacturers need to keep up with the dynamics of regulations, identify risks in advance, timely respond to regulatory compliance, and pay attention to the update of the exemption list and timely confirm the exemption to avoid export risks.

(4) Establish its own high-risk parts list and control mode.

For consistency management, enterprises need to identify and build their own high-risk parts list,

do a good job of risk identification, and dynamically manage the high-risk parts management mode within the enterprise to reduce the cost of full inspection.

7. Conclusions

(1) South Korea has brought the management of end-of-life vehicles into the legal level of management.

(2) South Korea ELV management have some differences with China ELV management and EU ELV management.

(3) Vehicle manufacturers (M1 and N1) whose target market is South Korea need to master the Korean regulatory requirements in advance and conduct product compliance checks in advance.

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