KEYSIGHT

Keysight General Specification for the Environment (GSE) Training

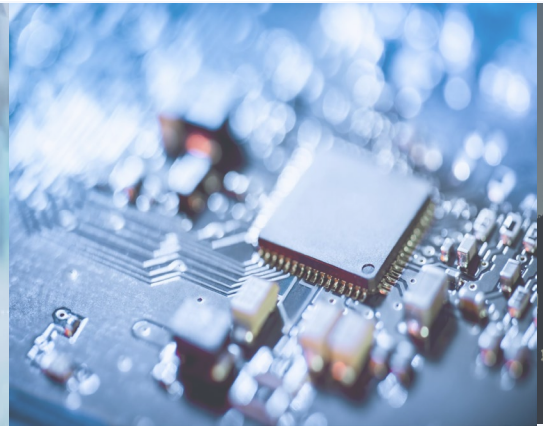
(Keysight's guidelines on materials restriction control in parts, components, and products used in Keysight devices, based on the Keysight General Specification for the Environment)

Last updated December 2025

Hazardous substance restrictions in products are based on regulations and guidelines aimed at limiting or eliminating the use of certain chemicals or materials that can be harmful to human health or the environment.

These restrictions are typically implemented through regulations and laws at local, national, regional or international levels.






International Standards and Regulations

International standards and regulations play a crucial role in setting environmental specifications and guidelines that govern various industries worldwide.

RoHS Directive

- Restricts the use of specific hazardous materials in electronics sold in the European Union.

REACH Regulation

- Regulates the production and use of chemicals to protect human health and the environment.

California Proposition 65

- Requires businesses to warn about exposure chemicals that can cause cancer or reproductive harm.

USA Toxic Substances Control Act

- Regulates chemicals to ensure they are safe for human health and the environment.

POPs Regulation (EU) 2019/1021

- Regulating the production, use, and release of persistent organic pollutants within the European Union to protect human health and the environment.

Stay Compliant to Environmental Regulations

Adhering to environmental regulations not only benefits an organization but also brings advantages to the broader community while ensuring the protection of the environment.

Protecting Human Health

Restricting hazardous substances reduces health risks.

Innovation

Encourages safer alternatives and sustainable practices, driving innovation.

Product Safety

Limits on hazardous substances ensure safer products, boosting customer trust.

Environmental Protection

Prevents contamination of soil and water, protecting ecosystems.

Trade Compliance

Compliance with international regulations avoids trade barriers, and legal issues.

Long-term Sustainability

Supports sustainability goals by reducing waste and environmental impact, promoting a circular economy

Roles and Responsibilities

Product Regulatory Compliance Team

- **Lead Regulatory Compliance Efforts**: Stay informed about relevant laws, regulations, and industry standards
- **Develop Compliance Strategies**: Define and implement company-wide strategies for compliance with restricted substance regulations for materials and packaging.

Procurement

- **Supplier Engagement and Communication**: Ensure suppliers understand and comply with Keysight's GSE requirements and provide necessary material declarations.
- **Source Compliant Materials**: Ensure that all sourced materials meet compliance standards for hazardous substances.
- **Material Substitution**: Collaborate with suppliers to substitute hazardous substances with compliant or safer alternatives when necessary.

Product Development/Engineering

- **Material and Design Selection**: Ensure that parts and materials selected for new product designs comply with restricted substance regulations. Assess product designs for the potential to introduce hazardous substances.
- **Compliance Verification**: Collaborate with regulatory compliance and procurement teams to verify the compliance of parts and materials used in product designs.
- **Substitution of Hazardous Materials**: Lead efforts to eliminate or replace hazardous substances in parts, materials, or packaging (e.g., lead, cadmium, mercury, certain flame retardants).

Suppliers

- **Provide Material Declarations**: Clearly disclose hazardous substances in materials, parts, and packaging.
- **Monitor Regulatory Changes**: Stay updated on changes in hazardous substance regulations and notify customers about relevant updates.
- **Replace Hazardous Substances**: Act to replace hazardous substances with safer alternatives where feasible.
- **Collaborate with Purchasers**: Work closely with the purchasing organization to meet hazardous substance management guidelines and requirements.
- **Participate in Audits**: Open to audits and assessments by the purchasing organization to confirm compliance with hazardous substance regulations.

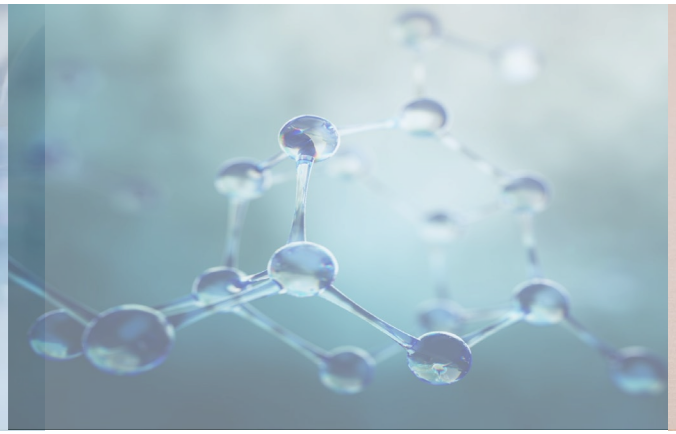
Keysight GSE

Keysight ensures its products are safe and globally compliant through the Keysight General Specification for the Environment (GSE). This specification establishes Keysight's materials restriction for purchased parts, components, materials, and products incorporated into Keysight products.

Scope

- **Purchased Parts and Materials:** Applies to parts, components, materials, and products used in Keysight products.
- **Transport and Recycling:** Includes marking, labeling, classification, and registration requirements for purchased parts and materials.
- **Exclusions:** Does not apply to substances used in manufacturing processes, except for Ozone Depleting Substances (ODS).

Keysight GSE Requirements


The **General Specification for Environmental** establishes Keysight's expectations for its products, including the following:

- **Materials Restrictions**
- **Product Content and ODS Use Restrictions**
- **Battery Content Restrictions**
- **Packaging Content Restrictions**
- **Product Labeling & Marking Requirements**
- **Chemical Registration Requirements**

Restricted Substances

- Restricted substances are prohibited for use in raw materials, parts, components, packaging or products
- The listed substances in this section must not present in any application.

Restricted Substances for any application

The following substances **must not present** in raw materials, parts, components, packaging or products.

IEC62474 ID	Substances	Examples Uses
00003	Asbestos, Asbestos Materials	Insulating material, plastic parts, Vermiculite
00018	Fluorinated Greenhouse Gases (PFC, SF6, HFC)	Refrigerants, blowing agents, extinguishing agents, cleaning agents, insulating media, caustic gas
00020	Hexabromocyclododecane (HBCDD)	Flame retardant; mainly used for expanded polystyrene and some types of fiber
00032	Ozone Depleting Substances (CFC, Halon, HBFC, HCFC & others)	Refrigerant, foaming agent, extinguishant, solvent cleaner
00035	2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	UV-stabilizer in adhesives, paints, printing inks, plastics, inked ribbons, putty, caulking or sealing fillers
00046	Polychlorinated Biphenyls (PCBs) and specific substitutes	Insulation oil, lubricant oil, electrical insulation medium, solvent, electrolytic solution, plasticizers, fire retardants, dielectric sealants
00048	Polychlorinated naphthalenes	Lubricant, paint, stabilizer (electric characteristic, flame-resistant, water- resistant) insulator, flame retardant
00052	Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	Plasticizer for PVC, flame retardant
00054	Bis(tributyltin)oxide (TBTO)	Antiseptic, antifungal agent, paint, pigment, antistaining, refrigerant, foaming agent, extinguishant, solvent cleaner
00064	Bis(pentabromophenyl) ether (decabromodiphenyl ether) (DecaBDE)	Flame retardant

Restricted Substances for any application

The following substances **must not present** in raw materials, parts, components, packaging or products.

IEC62474 ID	Substances	Examples Uses
00124 **00125**	Perfluorooctane sulfonate (PFOS)	Antistatic agent for films and plastics
00130	2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	UV stabilizer
00147	1,6,7,8,9,14,15,16,17,17,18,18-Dodecachloropentacyclo[12.2.1.16,9.02,13.05,10]octadeca-7,15-diene (“Dechlorane Plus”™)	Flame retardant for electric wire and cable covering material
00174	Phenol, Isopropylated Phosphate (3:1) (PIP (3:1))	Flame retardant and/or plasticizer in polymers such as flexible polyurethane foam and PVC, lubricant, hydraulic fluid, adhesives and sealants. Examples: gasket, wire sleeve, tape.
00178	Medium-chain chlorinated paraffins (MCCP)	Flame retardant and / or plasticizer in PVC and rubber, paints and coatings, adhesives and sealants, textiles and fabric.
00205	PFHxS-related compounds	Impurity in production of PFOS and alternative for PFOS; a surfactant which can be found in protective coatings and adhesives which are resistant to water, dirt, oils etc.
00001	Diarsenic pentoxide	Additive in wood; Wood based articles such as calibration boxes and product cases.

Restricted Substances for any application

The following substances **must not present** in raw materials, parts, components, packaging or products.

IEC62474 ID	Substances	Examples Uses
00002	Diarsenic trioxide	Additive in wood; Wood based articles such as calibration boxes and product cases.
00012	Chromium (VI) Compounds	Custom mechanical parts fabricated to Keysight engineering drawings
00171	Halogenated Flame Retardants	The use of halogenated flame retardants is not allowed in the enclosure and stand of electronic displays. Third Party computer monitors with a screen area > 100 square centimeters for inclusion into Keysight Solutions

Restricted Substances for Keysight Packaging

The following substances **must not present** in packaging.

Substance	Restricted Application	Basis
Arsenic Compounds	In wooden packaging and packaging materials	[EU] REACH Regulation (EC) No.1907/2006 ANNEX XVII
Cadmium/Cadmium compounds, Chromium (VI) Compounds, Lead/Lead Compounds	All packaging materials	[EU] Packaging Regulation (EU) 2025/40
Fluorinated Greenhouse Gases (PFC, SF6, HFC)	Blowing agents, cleaning agents, insulating media	[EU] REGULATION (EU) No 517/2014 on fluorinated greenhouse gases
Mercury compounds	In wooden packaging and packaging materials	[EU] REACH Regulation (EC) No.1907/2006 ANNEX XVII [EU] Packaging Regulation (EU) 2025/40

Restricted Substances for Keysight Packaging

The following substances **must not present** in packaging.

Substance	Restricted Application	Basis
Ozone Depleting Substances (CFC, Halon, HBFC, HCFC & others)	Foaming agent	[EU] Regulation on substances that deplete the ozone layer (EC) No. 1005/2009; [Japan] Law concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures; [USA] Clean Air Act; (Treaty) Montreal Protocol on Substances that Deplete the Ozone Layer

Product and Packaging Content Restrictions

- Maximum concentration level tolerated per homogeneous material
- Restrictions categorized into:
  - General Restrictions apply to any application
  - Specific Application apply to the specific applications
- Restrictions do not apply to chemical supplies like pure substances and mixtures

General Restrictions

- Substances must not be used in any applications above threshold
- Thresholds are defined per homogeneous material unless stated otherwise

General Restrictions (Example)

Substances	Example uses	Threshold	Basis
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	UV Stabilizer (additives that absorb UV light and convert it into heat, protecting the polymer from UV damage)	Must not be present	UN Stockholm Convention [EU] REACH Regulation (EC) No.1907/2006 ANNEX XIV. [Japan] Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc.; [EU] Persistent Organic Pollutants (POPs) Regulation (EU) 2019/1021 (pending)
Phenol, Isopropylated Phosphate (3:1) (PIP (3:1))	Flame retardant and/or plasticizer in polymers such as flexible polyurethane foam and PVC, lubricant, hydraulic fluid, adhesives and sealants. Examples: gasket, wire sleeve, tape	Must not be present	[USA] Toxic Substances Control Act (TSCA]
Bis (2-ethyl(hexyl)phthalate) (DEHP)	Plasticizer, dye, pigment, paint, ink, adhesive, lubricant	< 0.1%	[EU] RoHS Directive 2011/65/EU and its amendments; [EU] REACH Regulation (EC) No.1907/2006 ANNEX XIV
Dibutyl phthalate (DBP)			
Benzyl butyl phthalate (BBP)			
Diisobutyl phthalate (DIBP)			

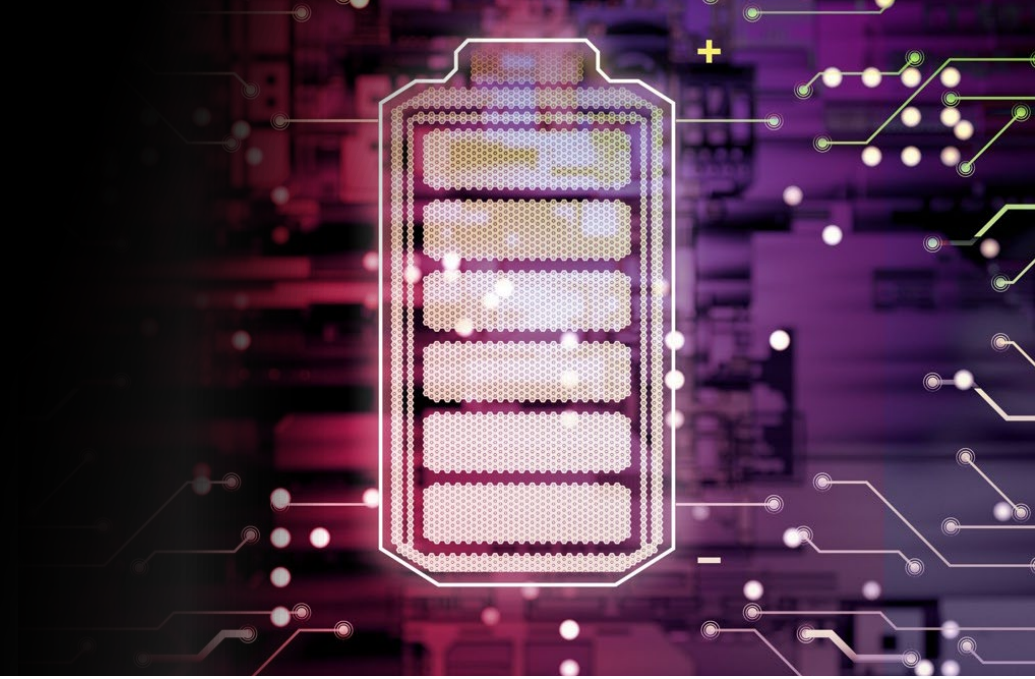
Specific Applications

- Substances must not be used in listed applications above threshold
  - Except in listed application exemptions
- Thresholds are defined per homogeneous material
- Application specific thresholds prevail over general restrictions
- Only for listed applications

Specific Application (Example)

Substances	Example uses	Threshold	Basis
Lead/Lead Compounds	Rubber hardener, pigment, paint, lubricant, plastic stabilizer, materials for battery, free-machining alloy, free-cutting steels, optical materials, X-ray shielding, solders etc.	<0.1%	[EU] RoHS Directive 2011/65/EU and its amendments, lead exemptions in Annexes III & IV
	PVC stabilizer in cable jackets	< 0.03%	[USA California] Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) Case law
Cadmium/Cadmium compounds	All applications, e.g. dyes, pigments, paints/enamels (excepting safety warnings), plastic stabilizer (e.g. electric cables), anti-corrosion coating finish and all other uses	<0.01%	[EU] RoHS Directive 2011/65/EU and its amendments, cadmium exemptions in Annexes III & IV
Formaldehyde	Additive in wood; Wood based articles such as calibration boxes and product cases.	0.062 mg/m3 of formaldehyde released	REACH Regulation (EC) No.1907/2006 ANNEX XVII specified test conditions
		<0.05 ppm	TSCA Title VI, 40 CFR Part 700 test methodology

Battery Content Restriction



- Prohibited or restricted substances for use in batteries
  - Battery-specific thresholds prevail over general restrictions
- All lithium metal and lithium-ion cells or batteries must meet requirements:
  - Requirements from UN Manual of Tests and Criteria, Part III, subsection 38.3
  - Additional requirements from ADR, IATA, IMDG, and Hazardous Materials Regulations of the United States Department of Transportation (49CFR)
- Vendor must provide a copy of specific test results upon request

Battery Content Restriction (Example)

Substances	Example uses	Threshold	Basis
Perchlorates	Lithium batteries; coin cell batteries	0.6 ppm by battery weight	[USA California] Perchlorate Contamination Prevention Act of 2003 AB 826
Lead/Lead Compounds	Zinc carbon batteries, alkaline button cells	0.004 mass% of battery	[EU] Regulation (EU) 2023/1542 on batteries and waste batteries; [China] Limitation of mercury, cadmium and lead contents for alkaline and non-alkaline zinc manganese dioxide batteries GB 24427-2009
Mercury/Mercury Compounds	Silver-oxide button cells, alkaline batteries, zinc carbon batteries	Intentionally added or 0.0001 mass% of battery	[EU] Regulation (EU) 2023/1542 on batteries and waste batteries; [China] Limitation of mercury, cadmium and lead contents for alkaline and non-alkaline zinc manganese dioxide batteries GB 24427-2009; [Taiwan] Restrictions on the Manufacture, Import, and Sale of Dry Cell Batteries; [Korea] Quality Management and Manufactured Product Safety Management Law (Battery Regulation)

Packaging Content Restriction

- Restricted substances for packaging materials
  - Specific thresholds for packaging materials prevail over general restrictions

Packaging Content Restriction (Example)

Substances	Example uses	Threshold	Basis
Arsenic Compounds	In wooden packaging and packaging materials	Must not be present	[EU] REACH Regulation (EC) No.1907/2006 ANNEX XVII
Cadmium/Cadmium compounds, Chromium (VI) Compounds, Lead/Lead Compounds	All packaging materials	Must not be present	[EU] Packaging Regulation (EU) 2025/40
Formaldehyde	In wooden packaging and packaging materials	0,062 mg/m3 of formaldehyde released under specified test conditions; and <0.05 ppm (TSCA TitleVI,40 test methodology)	[EU] REACH Regulation (EC) No.1907/2006 ANNEX XVII; [USA] Toxic Substances Control Act (TSCA)
Ozone Depleting Substances (CFC, Halon, HBFC, HCFC & others)	Foaming agent	Must not be present	[EU] Regulation on substances that deplete the ozone layer (EC) No. 1005/2009; [Japan] Law concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures; [USA] Clean Air Act; (Treaty) Montreal Protocol on Substances that Deplete the Ozone Layer
Tetraboron disodium heptaoxide, hydrate	In wooden packaging and packaging materials	0.1 mass% of article	[EU] REACH Regulation (EC) No.1907/2006 Candidate List for Authorisation

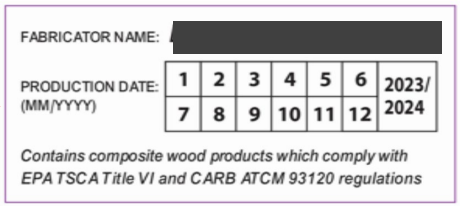
Content Restrictions Specific to Packaging

Phytosanitary Measures for Wood Packaging

- Wood must be free from bark, insects, and insect damage.
- Must be heat treated, or kiln dried to at least 56°C for 30 minutes.
- Must display an approved heat-treated or kiln-dried mark.
- NPPO-endorsed logo or mark must be visible on each unit.
- No fumigation, Chemical Pressure Impregnation (CPI), or other chemical treatments accepted.

Formaldehyde Marking Requirements

- Wooden articles must have a label or stamp with:
  - Fabricator name
  - Manufacturing date
  - Text: “TSCA Title VI compliant” in English and French



Product Labeling and Marking Requirements

- Product labeling and marking requirements are essential for ensuring product safety and compliance with regulations.

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Battery Requirements

- Durable labels with symbols and wording.
- Compliance with China's no mercury content requirements and provide necessary documentation.

Packaging Requirements

- Ensure paper and plastic packaging materials are identified, marked, and labeled.
- Provide a Declaration of Conformity for packaging when requested.

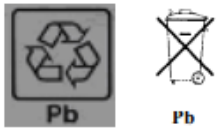
Mercury Product Requirements

- Label removable mercury lamps and products containing them as per local regulations.

Product Information and Labeling

- All goods sold and ship to China must Comply with Chinese regulations for hazardous substances, including product labels (include an EFUP or Environmentally Friendly Use Period number), toxic/hazardous substance tables, and date of manufacture.
- End of Life Labeling: Include the crossed-out wheeled bin label with bar for products requiring the European CE marking.

Labeling (Example)

PRODUCT TYPE	WORLDWIDE SYMBOL[3]	WORDING ON LABEL[2]
Alkaline batteries		- Manufacture's name and address - Either Chinese Low Mercury or - Mercury Free character - 无汞碱性电池
Lead-acid (sealed) batteries and their packaging		- Manufacturer's name and address - "BATTERY MUST BE RECYCLED" - "NON-SPILLABLE" OR "NON-SPILLABLE BATTERY" - "Pb" see Note 1
Lithium Metal cells and batteries		- Manufacturer's name and address - Lithium or , Lithium Metal - See Notes 5
Lithium Ion cells and batteries		- Manufacturer's name and address - Lithium Ion - Watt Hr - See Notes 2, 3 4
Nickel metal hydride batteries		- Manufacture's names and address - "CONTAINS NICKEL METAL HYDRIDE (NiMH) BATTERY" - Must be recycled or disposed of properly.
Rechargeable consumer products containing not easily removable sealed lead acid batteries		- Manufacturer's name and address - "CONTAINS SEALED LEAD BATTERY. BATTERY MUST BE RECYCLED." - "Pb" see Note 1

- **Pb Symbol**: Required on batteries with >0.004% lead.
- **Lithium-Ion Cells**: Max 20 Wh rating.
- **Lithium-Ion Batteries/Packs:** Max 100 Wh rating.
- **Marking**: Watt-hour rating must be on the case.
- **Lithium Metal Battery SDS**: Must include California Perchlorate Statement.

Chemical Registration Requirements

- Chemical substances must comply with registration requirements
  - Applies to parts, components, materials, and products sold to Keysight
  - Requirements in countries such as Australia, Canada, China, Japan, South Korea, Switzerland, the United States, and the countries of the European Union
  - Permits import and sale in these countries

Failure to Comply

Any **Non-Compliance** with the Keysight GSE might lead to the following:

Regulatory Non-Compliance

- Fines and penalties
- Legal actions, etc.

Reputational Damage

- Lost of trust
- Bad reputation

Operational Disruptions

- Delays assembly
- Cost increased

Financial Losses

- Loss of business opportunity
- Liabilities increased

Supply Chain Issues

- Supply Chain disruptions

Reporting Channel

- Any non-compliance or concerns of GSE requirements can be reported through GSE_Inquiry@keysight.com
- The substances listed in GSE document: Appendix C must be reported to Keysight as material content for raw materials, parts, components, or products supplied to Keysight.
- Substances published by ECHA in the EU REACH candidate List after 14 June 2023 must also be reported if content is > 0.1% wt/wt.

Conclusion

- Keysight Technologies' General Specification for the Environment ensures that all products and materials meet stringent environmental standards.
- By adhering to these guidelines, Keysight aims to minimize environmental impact, ensure regulatory compliance, and promote sustainable practices across its supply chain.
- This commitment to environmental responsibility not only protects the planet but also enhances the company's reputation and operational efficiency.

Key Takeaways

GSE Applicable Scopes
Clearly define the scopes of the General Specification for the Environment (GSE).

Importance of Compliance
Understand why adhering to environmental regulations is crucial.

Role in GSE Implementation
Recognize the individual role in ensuring successful GSE implementation.

Threshold Differences
Differentiate between the threshold levels for General Applications and Specific Applications.

Requirements Overview
Comprehend the specific requirements for Battery Restrictions, Packaging Content Restrictions, Labelling & Marking, and Chemical Registration.

Implications of Non-Compliance
Understand the potential consequences of not complying with GSE on Keysight, including regulatory, reputational, operational, financial, and supply chain impacts.

Reference Resources

- The information presented herein is based on the Keysight General Specification for the Environment.

Thank you