



WHITE PAPER:

GHS Chemical Labeling Compliance: Requirements & Solutions

INTRODUCTION

Until 2003, chemical labels were regulated by standards created by individual nations, usually with advice and commentary from related industry groups. We now find ourselves in an era of globalization, in which the manufacturing, packaging, transport, sale, and use of chemicals and chemical products is accomplished by a globally interconnected supply chain.

Driven by the recognition that chemicals must be classified and labeled under a universally understood communications system, in order to avoid risks to human health and the environment, every nation in the

world has agreed to harmonize chemical hazard communications under a system developed by the United Nations (UN) and the International Labor Organization (ILO). This Globally Harmonized System of Classification and Labeling of Chemicals, commonly known as GHS, was adopted by consensus in 2003 by the United Nations Economic and Social Council.

The following paper summarizes GHS regulations as they pertain to chemical product labeling and documentation.

SCOPE AND COSTS OF GHS LABEL CHANGES

International Compliance, Differing Guidelines within GHS, and Packaging Reform

The transition to GHS communications standards is a significant task that is requiring manufacturers to re-document and re-label all chemical products by the deadline date for implementation in their geographic region – most by 2015. Manufacturers need to ensure that Material Safety Data Sheet (MSDS) documentation meets new GHS standards, and that all product labels, including labels for shipping cartons, secondary packages, and primary product labels, comply with the new pictograms, product identifiers, signal words, hazard statements, and precautionary statements of the Globally Harmonized System.

Costs of GHS Labeling are varied, and many chemical manufacturers are finding that some are coming from shipping to regions in different stages of GHS implementation, and those that are enforcing the GHS

standards with different measures. The European Union, United States, Canada, and Asian countries are all moving towards GHS compliance at different rates, and with different final standards.

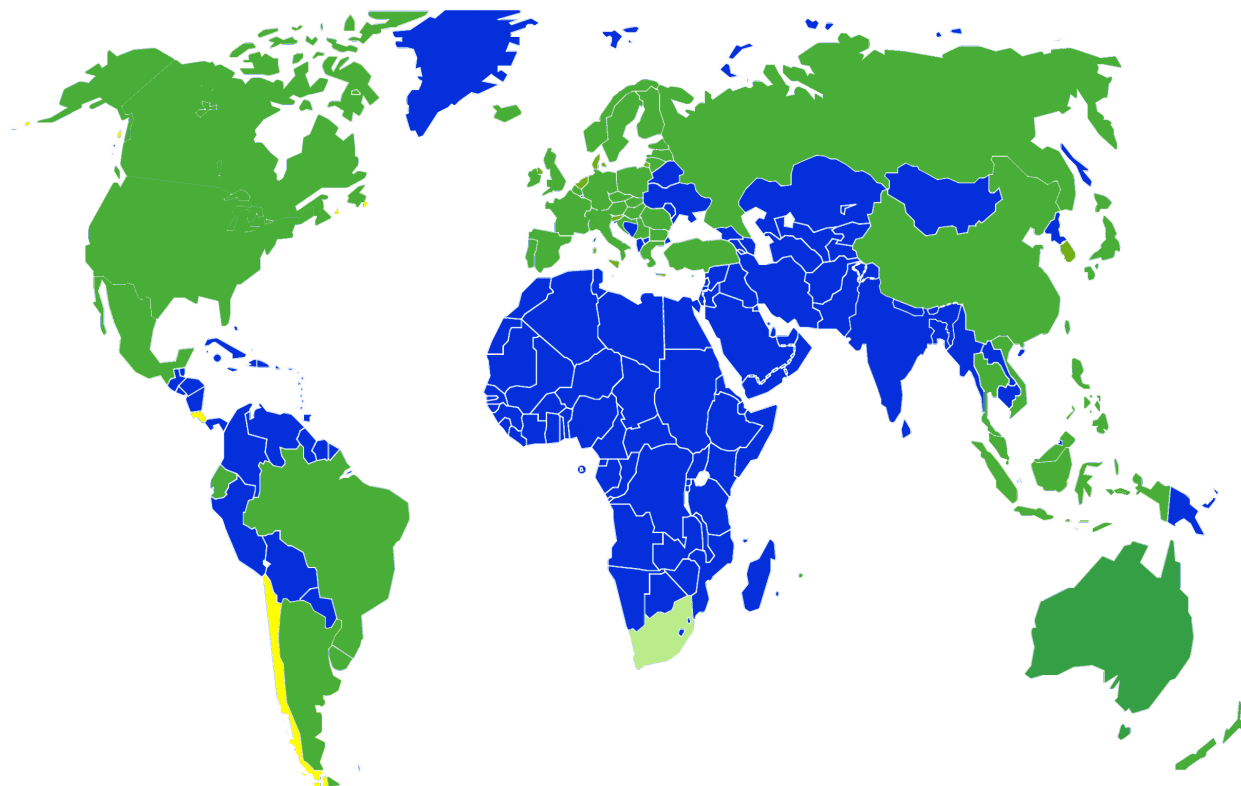
Although all of these packaging guidelines are GHS compliant, they do have subtle differences in language, size and orientation rules – when a company ships chemicals to each of these countries distinct packaging is needed for each location. From shipment to shipment, packaging an unpredictable amount of specific chemicals with unique GHS labels is a process that can be difficult to prepare for, without the appropriate packaging solution.

After the European Union adopted GHS in 2012, most of the rest of the participating U.N. countries will be fully GHS-compliant by June 2015. However, in 2017 non-compliant countries still remain.



Current Status of GHS Implementation Worldwide

- : Countries/regions that have already implemented GHS.
 - : Countries/regions where GHS is voluntary.
 - : Countries/regions that are in the process of implementing GHS.
 - : Countries/regions where GHS is not implemented or not available.
- (Source: DHI Group)



Benefits of the GHS Label Standards

Increased Safety, Communication, and Trade Facilitation

While the industry is required to bear the costs of re-assessing and re-packaging chemical products, it is important to note that there are benefits of GHS labeling.

GHS allows for a simpler export of chemical products to foreign markets, with no more country-specific documentation and testing standards, workplace safety standards, and environmental standards.

GHS further protects human health and the environment with consistent international hazard communication to inform all users throughout the chemical supply chain to the presence of a hazard. Compliance also minimizes exposure and risk to those hazardous chemicals, through safer transportation, handling and use.

In all participating countries, GHS ensures safe management of chemicals through identifying hazards and communicating them. This is particularly useful for countries without well-developed regulatory systems.

Eliminating the time-consuming activities necessary to meet multiple international classification and labeling guidelines, GHS also provides increased and simplified international trade, leading to improved communication and growth in international markets for companies seeking to import and export chemical goods.

Deadlines for Compliance

GHS labeling regulations are now legally required and implemented within the European Union, United States, Canada and the majority of countries in Asia and South America. Each region has taken a multi-phasic approach to adoption of GHS standards, with interim deadlines for compliance by chemical type.

Currently, GHS compliant labels are required for pure substance chemical products manufactured, imported, shipped, or advertised within Europe or to Europe. Throughout the United States, Canada and most of Asia and South America, GHS compliance with pure substances and chemical mixtures is presently in effect.

European Union		
<i>Includes countries of: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Netherlands and the United Kingdom.</i>		
Chemical Substance/Functional Area	Previous standard, replaced by GHS	Deadline Date for Adoption of GHS Label and GHS MSDS Format
Pure Chemical Substances <i>(Explosives; Flammable gases; Flammable aerosols; Oxidizing gases; Gases Under pressure; Flammable liquids; Flammable solids; Self-reactive substances and mixtures; Pyrophoric liquids; Pyrophoric solids; Self-heating substances and mixtures; Substances and mixtures which in contact with water will emit Oxidizing liquids, Oxidizing solids, Oxidizing peroxides, Corrosive to metals)</i>	DSD/DPD, Country-specific standards	Implemented
Submit Notification to of Chemical Substances Placed on the Market as of 1 December 2011 to European Chemicals Agency	--	Implemented
Transition Period for Pure Substances which are Manufactured and "On-the-Shelf" Before 1 December 2010 <i>(Grace period, allows use of labels that do not meet GHS standards)</i>	DSD/DPD, Country-specific standards	Implemented
Chemical Mixtures <i>(Examples include adhesives, dyes, laboratory chemicals, paints, plastics, solvents, and chemicals used in cleaning products, cosmetics, and toiletries)</i>	DSD/DPD, Country-Specific standards	Implemented
Transition Period for Chemical Mixtures which are Manufactured and "On-the-Shelf" before 1 June 2015 <i>(Grace period, allows use of labels that do not meet GHS standards)</i>	DSD/DPD, Country-specific standards	Implemented

Pesticides	FAO, DSD/DPD, WHO	Implemented
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Asia		
<i>Countries of: China, Japan, Korea, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, Australia, New Zealand</i>		
Chemical Substance/Functional Area	Previous standard, replaced by GHS	Deadline Date for Adoption
Pure Chemical Substances: <i>(Explosives; Flammable gases; Flammable aerosols; Oxidizing gases; Gases Under pressure; Flammable liquids; Flammable solids; Self-reactive substances and mixtures; Pyrophoric liquids; Pyrophoric solids; Self-heating substances and mixtures; Substances and mixtures which in contact with water will emit Oxidizing liquids, Oxidizing solids, Oxidizing peroxides, Corrosive to metals)</i>	- Australia: NOHSC, SWA - Japan: CSCL, ISHL - Philippines: OSHS - Singapore: EPMA, WSHA	- Australia: Implemented - China : Implemented - Japan: Implemented - Korea : Implemented - Indonesia: Implemented - Malaysia : Implemented - New Zealand : Implemented - Philippines: Implemented - Singapore: Implemented - Taiwan: Implemented
Chemical Mixtures: <i>(Examples include adhesives, dyes, laboratory chemicals, paints, plastics, solvents, and chemicals used in cleaning products, cosmetics, and toiletries)</i>	- Australia: NOHSC, SWA	- Australia: Implemented - China: Implemented - Japan: Implemented - Korea: Implemented - Indonesia: Implemented - Malaysia: Implemented - New Zealand: Implemented - Philippines: Implemented - Singapore: Implemented - Thailand: Implemented
Pesticides	- Australia: AVCCA, NOHSC, SWA - Japan (PDSCL)	- Australia: Implemented

Canada		
Chemical Substance/Functional Area	Previous standard, replaced by GHS	Deadline Date for Adoption
Pure Chemical Substances: <i>(Explosives; Flammable gases; Flammable aerosols; Oxidizing gases; Gases Under pressure; Flammable liquids; Flammable solids; Self-reactive substances and mixtures; Pyrophoric liquids; Pyrophoric solids; Self-heating substances and mixtures; Substances and mixtures which in contact with water will emit Oxidizing liquids, Oxidizing solids, Oxidizing peroxides, Corrosive to metals)</i>	WHMIS	Implemented
Pesticides	PMRA, CPSB, WHMIS	Implemented
Hazardous Goods for Transport	Transport Canada, WHMIS	Implemented

Chemical Mixtures: Examples include adhesives, dyes, laboratory chemicals, paints, plastics, solvents, and chemicals used in cleaning products, cosmetics, and toiletries	WHMIS, CPSB	Implemented
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United States		
Chemical Substance/Functional Area	Previous standard, replaced by GHS	Deadline Date for Adoption
Pure Chemical Substances: <i>(Explosives; Flammable gases; Flammable aerosols; Oxidizing gases; Gases Under pressure; Flammable liquids; Flammable solids; Self-reactive substances and mixtures; Pyrophoric liquids; Pyrophoric solids; Self-heating substances and mixtures; Substances and mixtures which in contact with water will emit Oxidizing liquids, Oxidizing solids, Oxidizing peroxides, Corrosive to metals)</i>	ANSI, EPA, OSHA	Implemented
Pesticides	ANSI, EPA, OSHA	Implemented
Hazardous Goods for Transport	ANSI, DOT, OSHA	Implemented
Chemical Mixtures: <i>(Examples include adhesives, dyes, laboratory chemicals, paints, plastics, solvents, and chemicals used in cleaning products, cosmetics, and toiletries)</i>	ANSI, DOT, OSHA	Implemented

Required GHS Label Elements

Under GHS regulations, a Product Identifier, Pictogram, Signal Word, Hazard Statement, and Supplier Information must be stated on each chemical product label.

- **Product Identifier**

A Product Identifier is the ingredient name or number of the pure chemical substance or chemical mixture. The technical name(s) must be harmonized with IUPAC, CAS and with the technical name(s) listed on the MSDS sheet. It must also be harmonized with the UN Proper Shipping Name if the chemical is regulated under the United Nations Recommendations on the Transport of Dangerous Goods (UNRTDG). The Product Identifier is meant to prevent accidental or uninformed exposure. A worker, shipper, or supply chain partner must be able to accurately identify the chemical and recognize its potential hazard.

- **GHS Pictograms**

Each red, black, and white point-set, square-shaped pictogram conveys information about particular hazardous risks associated with a chemical. In combination with the Signal Word "Danger" or "Warning," the pictogram communicates the severity of the risk, and is meant to prevent accidental or uninformed exposure. More than one pictogram may be used on the same chemical label, if applicable. The size of the pictogram, and other label elements, should be proportionate to the physical dimensions of the label. (For more detailed information, see below "GHS Label Pictograms" and "GHS Label Size Requirements")

- **Signal Words**

Either "**Danger**" or "**Warning**" used to emphasize hazards and indicate the relative level of severity of the hazard, assigned to a GHS hazard class and category: "**Danger**" for the more severe hazards, and "**Warning**" for the less severe hazards. Signal words are standardized and assigned to the hazard categories within endpoints. Some lower level hazard categories do not use signal words. Only one signal word corresponding to the class of the most severe hazard should be used on a label.

- **Hazard Statements**

These phrases describe the nature and degree of the hazard posed by the chemical. All hazard statements should be included on the label for a substance/mixture possessing more than one hazard. An example of a hazard statement would be "Heating may cause an explosion."

- **Precautionary Statement**

These statements must related to the GHS pictogram, and further describe measures that should be taken to minimize or prevent risks associated with the hazard. The number of precautionary statements should be kept to a maximum of six. An example of a precautionary statement would be: "Keep away from heat/sparks/open flames/hot surfaces – no smoking" in relation to a pictogram that shows Explosive Danger and a Hazard Statement such as "Heating may cause an explosion."

- **Supplier Information**

Each chemical container, including secondary packaging such as crates and master cases, must include a GHS label printed with the Supplier Information. This must include the name, address, and telephone number of the manufacturer or supplier of the product.

- **Supplementary Information**

The Supplementary Information is additional product information volunteered by the manufacturer, supplier, or other responsible party. It is acceptable for the manufacturer to make a statement that is not harmonized with the GHS standards. However, the statement must not conflict with GHS standards.

GHS Label Size Requirements

Most countries do not require minimum label sizes for GHS labels, however stipulate that GHS labels are easily readable. In the European Union label minimums are outlined, depending on the capacity of the container. Within the European Union, the proper minimum label dimensions based on container size are depicted on the chart below:

Container Capacity	Required GHS Label Dimensions
< 3 liters (< 3 .17 quarts)	52mm X 74mm (2.04" x 2.91")
2 – 50 liters (3.17 – 13.2 gallons)	74mm – 105mm (2.91" x 4.133")
50-500 liters (13.2 – 132 gallons)	105mm – 148mm (4.133" x 5.82")
≥500 liters (≥ 132 gallons)	148mm – 210mm (5.82" x 8.26")

Printing GHS Labels In-House

The variety of GHS label formats and size configurations has made the prospect of printing labels in-house, tailored for each chemical product, attractive to many chemical manufacturers. There are typically three options for printing GHS labels as part of an in-house packaging process:

Option One: Printing Labels with a Barcode Printer

In this scenario, a barcode label printer is used to print pictograms, signal words, manufacturer address, and other text in one-color: black. Secondary and additional colors, red for the GHS pictograms and other colors for logos and branding, are pre-printed onto a roll of labels.

This pre-printed roll is inserted on a thermal transfer barcode printer, which prints the black-colored portion of the label, including the black section of the GHS pictograms, signal words, hazard warning, and other text with a black-colored thermal transfer ribbon.

This solution requires a large inventory of pre-printed labels, and a separate pre-printed roll for each variation in chemical label: different countries, languages, pictograms each get their own pre-printed roll. This presents a logistical challenge in a production setting, where packaging staff are required to identify and select the correct pre-printed label roll from among the many rolls on warehouse shelves for each batch.

Option Two: Printing Labels with a 2-Color Label Printer

A digital label printer capable of printing labels in two different colors, in one printing pass, provides manufacturers with the flexibility to make durable, color-fast labels with different GHS label content, in different label sizes, according to production demand.

When different label stock sizes are required because the physical dimensions of the container have changed, the two-color label printer can be re-loaded with a blank roll of labels in the desired size. This solution may suffice for label printers that offer adequate width to accommodate GHS label size requirements.

With a typically moderate price point and widely-accepted thermal transfer print technology, the two-color label printer can be a cost-effective and familiar solution for companies migrating from in-house barcode/monochrome label printing to in-house printing of red and black GHS labels and other dual-colored pictograms used on chemical labels covered by the UN Recommendations for the Transport of Dangerous Goods (UNRTDG).

However, this solution only satisfies GHS requirements, and does little to allow for branding, marketing and private labeling efforts. For companies that do private labeling, joint labeling with retailers and wholesalers, and package chemical products to be displayed on store shelves, a two color thermal processor may not offer a complete solution.

Option Three: Printing Labels with a Full-Color Label Printer

A full color digital label printer grants the capability of printing variable GHS labels with maximum flexibility to comply with GHS labeling regulations, along with customer and retailer demand.

Chemical manufacturers are finding that a full-color label printer provides them the most flexibility for printing GHS labels for international and domestic markets, wholesalers, and private label retailers.

A four-color printer can satisfy BS5609, GHS, private, and custom labeling requirements at the same time. However, an in-house full color digital label printer gives chemical manufacturers the capacity to print labels that integrate all GHS required elements, as well as the ability to create graphic-rich primary display panels that include logos and branding - all in the same label printing process.

If the full-color label printer has the capacity to directly address an Enterprise Resource Planning (ERP) system or other company database, the manufacturer would also be able to centrally manage label production.

This allows a manufacturer to quickly access information to print BS5609-compliant color labels with product specific and batch-specific label content; GHS required language, pictograms, in addition to full-color material for marketing and branding. With this, manufacturers can then create an internal labeling system that includes GHS-compliant information, along with brands, logos, photos, illustrations, and other trade dress. Accessing their labels in an ERP system can make printing any quantity of label a simplified solution which ensures the correct label content is automatically printed each of their product labels, to greatly reduce labeling errors.

Use of Color-Coded Pictograms on GHS Labels




The GHS labeling standard require visual, color-coded hazard warnings as part of its aim to make chemical hazard warnings universally understood. The purpose is to overcome the barriers created by the use of different languages and by illiteracy, by visually conveying information about chemical hazards and safety measures. The use of the same standard symbols (pictograms) and color codes on chemical labels around the world ensures that workers who handle chemicals during production, transport, or at the point of use will share the same recognition and understanding of the GHS hazard warning system.

Most GHS labels consist of a white background inside a red-colored diamond frame, with a black-colored symbol printed over the white area. Transport labels, which continue to use additional colors and symbols developed by the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, are the exception.











GHS Label Pictograms and Hazard Classes

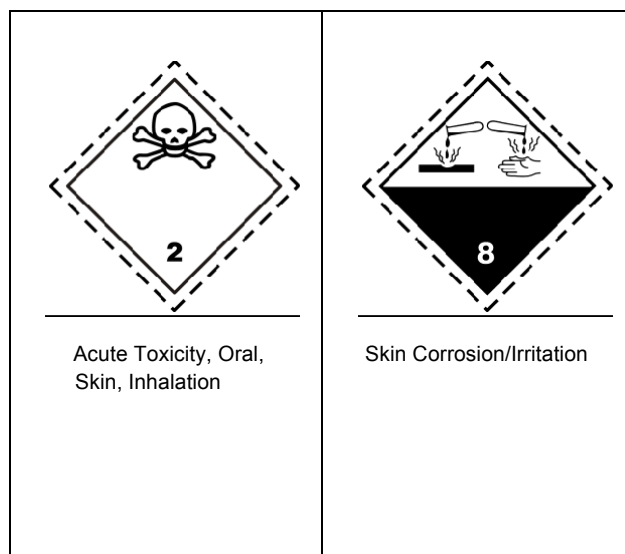
Each pictogram must be combined with a signal word, standardized hazard statements corresponding to health, physical, and environmental hazard class, precautionary statements, and the name, address, and the telephone number of the chemical manufacturer, importer, or other responsible party. More information about GHS pictograms is available at the UN Economic Commission website, [Annex I, Allocation of Label Elements](#).

Printable artwork for GHS pictograms can be downloaded from the UN website at:
<http://www.unece.org/trans/danger/publi/ghs/pictograms.html>.

 <p>Explosive: Heating may cause fire or explosion</p>	 <p>Oxidizer may intensify fire; Oxidizing gas; Flammable gas; Flammable Aerosol; Flammable Liquid; Flammable Solid; Heating may cause a fire</p>	 <p>In contact with water, releases flammable gas; Self-reactive substance or mixture; Self-heating; Catches fire spontaneously or exposed to air</p>
 <p>Gas Under Pressure</p>	 <p>Corrosive to metals; Causes serious eye damage</p>	 <p>Acute toxicity, oral; Acute toxicity skin; Causes skin irritation; Causes serious eye irritation</p>
 <p>Germ cell mutagenicity, Carcinogenicity; Organ Damage, Birth defects, Aspiration hazard, Breathing difficulties, Allergies, or Asthma if inhaled</p>	 <p>Aquatic environmental toxicity, Acute aquatic environmental toxicity, chronic</p>	 <p>Harmful if swallowed, Toxic if inhaled; Harmful in contact with skin, May cause an allergic skin reaction; May cause respiratory irritation</p>

Transport Label Pictograms (valid under GHS)

 <p>Explosive, Division 1.1, Self-reactive</p>	 <p>Explosive, Division 1.2</p>	 <p>Explosive, Division 1.3</p>	 <p>Explosive, Division 1.4</p>
 <p>Explosive, Division 1.5</p>	 <p>Explosive, Division 1.6</p>	 <p>Flammable gas, Flammable aerosol</p>	 <p>Oxidizer, Oxidizing liquid, Oxidizing solid</p>
 <p>Gas under pressure</p>	 <p>Gas under pressure</p>	 <p>Flammable liquid and vapor</p>	 <p>Flammable Solid, Self- reactive Substance or Mixture</p>
 <p>Pyrophoric Liquid, Pyrophoric Solid, Self- Heating Substance or Mixture</p>	 <p>Substance Emits Flammable Gasses</p>	 <p>Organic Peroxides</p>	 <p>Corrosive to Metals</p>



GHS Label Material Standards

GHS imposes packaging material requirements consistent with its safety measures aimed at containing chemical hazards. In Europe, the CLP (Classification, Labeling, and Packaging) Regulation administered by the European Chemical Agency under EC Regulation No 1272/2008 require GHS-compliant packaging must:

- Prevent the chemical from escaping
- Not be adversely affected by the chemical
- Be strong enough to withstand normal handling and repeated use

In order to satisfy GHS label standards for permanence and imperviousness, GHS label substrates must be chemical-resistant, abrasion-resistant, UV light resistant, weather-resistant, and utilize a marine-grade label adhesive.

For the transport of dangerous goods by sea, GHS standards require certain products meet the International Maritime Dangerous Goods Code (IMDG) certification standard, which seeks to prevent pollution resulting from the damage or loss of a chemical transport container at sea. In order to preserve the hazard warning label, IMDG and GHS standards require that labels meet British Standard BS 5609 under which printed label materials must survive three months of saltwater submersion without fading, while maintaining adhesion to the container.

MSDS Documentation Requirements under GHS

The new GHS hazard warning communications system applies to MSDS data sheets, which are intended to provide information to manage chemical safety in the workplace, as well as to product labels.

The new MSDS sheet formats, and new MSDS information requirements, have been established under EC No 1272/2008. The new MSDS format is similar to the previous ISO, EU, and ANSI safety data sheet format, but has 16 sections, including new sections on Ecological impact, Disposal Considerations, Transport Information, and Regulatory Information. Manufacturers must adopt the new GHS MSDS sheet format under the same deadlines for adoption of GHS label formats.

More Information about GHS Labeling and Label Printing:

[European Commission: Classification and Labeling CLP/GHS](#)

[A Guide to the Globally Harmonized System of Classification and Labeling of Chemicals \(OSHA\)](#)

[GHS Implementation: World Map](#)

[US Department of Labor \(OSHA\)](#)

[Canadian GHS Labeling Implementation Schedule - Health Canada](#)

[QuickLabel Digital Color Label Printer Models](#)

[QuickLabel Label and Ink Supplies](#)

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