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GHS— The Global Harmonized System of Classification and Labeling of Chemicals– CISA Chemical SRMA Informational Webinar

Slide 1 "CISA Logo"

The following webinar is part of CISA's work as the Chemical Sector Risk Management Agency. We strive to provide resources, information, and training related to the chemical sector to enhance the resilience of the sector and cross sector coordination. Enjoy the webinar, provided by two of our HS-Power Interns, and take what you learn to enhance critical infrastructure security!

Slide 2: "Globally Harmonized System of Classification and Labeling of Chemicals"

Hello everyone, welcome and thank you for attending our presentation today in which we will be explaining the Globally Harmonized System of Classification and Labeling of Chemicals – Otherwise known as "GHS Symbols." Derek and I will be presenting this content to you today, we are HS-POWER Interns at CISA. I will be covering the first half of the symbols, and then I will hand it over to Derek to finish the second half.

Slide 3: "What are GHS Symbols?"

So, what are GHS Symbols? They are 9 different symbols that give warnings that help point out substances and materials that have specific qualities that make them hazardous. Each of the 9 symbols are used to identify a specific dangerous property that a particular material has. These properties are called hazards. While all of these symbols represent danger, some of them are broad. For the broader warnings and hazards, a classification scale of 1-4 is used (1 being the most hazardous and 4 being the least hazardous). When we cover the symbols, we will indicate whether they have additional classification scales.

Slide 4: "GHS – Flammable"

Why is it important to identify something as flammable? When something is flammable, it is more likely to catch fire when exposed to certain conditions. Some of these conditions include increased temperature and pressure or exposure to sparks or other oxidizers. Though caution is always good around chemicals, particularly flammable chemicals. For things that have increased flammability, increased caution is necessary. These items can catch fire simply when exposed to air or an existing fire. When something burns, it releases gas. There are flammable and non-flammable substances when burned release a gas that is very flammable and/or toxic. Some examples of these flammable chemicals include gases and fossil fuels i.e., Butane, Used as a heating fuel, a refrigerant, and a propellant in aerosols. Methane, Used in energy production. Petroleum Fuel, Transportation, Heating, Electricity.

Slide 5: "GHS – Oxidizer"

Why is it important to point out an oxidizer? What is so special about them? Oxidizers can create a fire even when air is not present. This is because for something to burn, oxygen is

necessary. On one hand, when there is no air or oxygen present, one may assume that something cannot burn. On the other hand, with an oxidizer, there is a large amount of oxygen within it, allowing for something else to take that oxygen and use it to create a fire. Part of the reason oxygen is so easy to burn is because of its increased electronegativity. So, other electronegative things can be oxidizers, but since Oxygen is more electronegative, it is the most effective and common. If there is already a fire, an oxidizer (the oxygen within the oxidizer can just be used to fuel it. For these chemicals to be safely and securely contained they need to be transported, stored, and used in proper conditions. Some examples of oxidizers are Potassium perchlorate in Flares, Rocket Propellants, Car Air Bags, Photography, etc. Ammonium nitrate for making matches and some explosives. Hydrogen peroxide in cleaning supplies, bleach hair, etc. Chlorine to disinfect water as part of sanitation process, also used as bleach for paper and cloth, in pharmaceuticals, and in cleaning products (as bleach).

Slide 6: "GHS – Explosive"

Why are explosives important to note? Although an explosive material sounds self-explanatory, there are multiple reasons why something can be explosive. This is why it is important to identify when and why something is explosive. An explosion can occur if something reacts with a highly unstable material. Something is unstable itself, being able to violently react with many different things. If something is unstable enough, it can react with itself spontaneously to create an explosive result. Some examples of explosive materials are bombs, such as dynamite. TNT, which is used to create bombs, but very explosive itself. Gunpowder, which is used in guns and bombs.

Slide 7: "GHS - Compressed Gas"

What are compressed gases and why do they need a hazard symbol? Gases that are under pressure can be dangerous due to the difference in pressure of the container and the ambient pressure. Sometimes these chemicals are safer and more stable when stored under pressurized conditions. Other times, these chemicals are stored under pressurized conditions to decrease the storage footprint or for other use-case specific reasons. However, since they are under intense pressure, they might be more stable in the container, but the container needs to be handled delicately. The emblem depicts that there is a container with intense pressure, which can be dangerous – with or without the addition of dangerous gases within them. Hazardous gases can also be liquefied to make them safer to handle. The level of potential hazard depends on the intensity of the pressure and the level of temperature. When dealing with a container of hazardous gas, there are 4 types of gas that it can be: A compressed gas – which is a gas simply put into conditions of high pressure. Liquefied gas – A gas that has been liquefied and is kept at high pressure to keep it liquid within the container. Dissolved Gas – A gas that is dissolved within another material to make it safer to store and/or transfer it. Refrigerated liquefied gas – A gas that has been liquefied but to stay liquefied, it needs to stay in cold temperatures. Each of these classifications carry different level of hazards. Some examples of these gases are Helium in Balloons, Cryogenic cooling, etc.;

Butane used as a heating fuel, a refrigerant, and a propellant in aerosols; Carbon Dioxide in a small percentage of our breathing air (0.04%), food and beverage, etc.

Slide 8: "GHS – Corrosive"

What is the corrosive symbol and why is it necessary? The symbol shows a chemical being poured onto both a solid object and a human hand, causing damage and degradation to either organic or inorganic materials. Depending upon the chemical, Personal Protective Equipment, or PPE may be required. Whether or not PPE is required will be listed within the material's Safety Data Sheet, or SDS. Some types of PPE that MAY be required are gloves, eye goggles, or a face shield, but it is not limited to those items. One can easily find an SDS for most materials online by searching for the "Chemical name" and "SDS" on their favorite search engine. This group has 3 classes. Class 1 is corrosive to metals. Class 2 is skin corrosion or irritation. Class 3 is serious eye damage or eye irritation. Some examples of corrosives are sulfuric acid which is used in the manufacture of fertilizers, chemicals, drugs, and more; sodium hydroxide which is used in solvents and cleaners, as well as in the water wastewater treatment industry to adjust acidity; and zinc chloride is used as a catalyst in the creation of chemicals on an industrial scale.

Slide 9: "GHS - Acute Toxicity"

What is the acute toxicity symbol and why is it necessary? The symbol shows a skull and crossbones which signifies a substance is toxic or deadly. Acutely toxic chemicals are poisonous even with minimal amounts of contact via swallowing, skin contact, or breathing in vapors. Handling of these substances may require usage of personal protective equipment. The PPE requirements will be listed on the label. For example, it will say "Wear protective gloves", or some other type of PPE. This pictogram has 3 groupings, which are defined by the route of contact. The 3 modes of contact are oral ingestion, dermal, meaning contact with skin, or inhalation. A chemical can have Acute Toxicity in more than one mode of contact. Within these modes of contact are three categories. Categories 1 and 2 are fatal if swallowed. While category 3 is toxic if swallowed. These chemicals will include a precautionary statement about handling, as well as response if a spill occurs, and storage and disposal requirements. For example, the SDS may list under "precautionary Response", "Immediately call a POISON CENTER or physician if swallowed". Some examples of Acute Toxicity chemicals are hydrofluoric acid which is an acid that is used in etching, metal cleaning and electronics manufacturing; fentanyl, which is an extremely powerful painkiller, when ingested, on the skin, or inhaled can be fatal; Coumadin, which is used as a blood thinning medication in humans is also used in rat poison

Slide 10: "GHS – Irritant"

What is the irritant symbol and why is it necessary? The symbol shows an exclamation point which is meant to signify a substance is an irritant. Chemicals that are irritants may cause skin and eye irritation, as well as skin sensitization. Skin sensitization is when the body has an allergic reaction to the substance and may cause a rash, or bumps on the skin. Depending upon the chemical, Personal Protective Equipment, or PPE may be required. If PPE is required, the types of PPE necessary will be listed on the label. This pictogram has 4 groupings, which are defined by the effect of contact. The 4 groupings are categories 1 through 4. Category 1 products MAY cause allergic reaction. Category 2 products WILL cause injury but the effects will subside within 21 days of exposure. Category 3 products irritate a specific organ, like the lungs if the irritant is inhaled. Category 4 products are known

to be harmful if contacted via swallowing, getting on the skin, or inhaling. Some examples of irritants are sulfuric acid which is used in lead-acid batteries and in the production of fertilizers; hydrochloric acid which is commonly used as a pool chemical to adjust the pH, and for metal cleaning; sodium hydroxide which is commonly used in food production and adjusting the levels of acidity in water wastewater treatment.

Slide 11: "GHS - Environmentally Toxic"

What is the environmentally toxic symbol and why is it necessary? The symbol shows a leafless tree and a dead fish meant to signify that release into the environment may be toxic to, disfigure, or kill plants and animals, highlighting that it can be especially damaging to aquatic life. Chemicals that are environmentally toxic present hazards when released into soils, rivers, streams, and lakes. This pictogram has 4 groupings, which are defined by how toxic it is to aquatic life. In addition to that it will also list if a chemical has acute, meaning short term, or long-term effects in the environment. The 4 groupings are categories 1 through 4. Category 1 products are VERY toxic to aquatic life. Category 2 products are toxic to aquatic life. Category 3 products are harmful to aquatic life. Category 4 products MAY have harmful effects. These chemicals will include a precautionary statement that says, "avoid release into the environment". The label will also include a statement with disposal instructions, it is imperative that those who are responsible for disposing of the product follow the instructions. Some examples of environmentally toxic chemicals are laminating epoxy resin which is used as a sealant for many types of products; chlorine which is one of the most widely used chemicals for manufacturing products and other chemicals; polychlorinated biphenyls which are used in plastic and rubber manufacturing, as well as in industrial and electrical equipment.

Slide 12: "GHS - Health Hazard"

What is the health hazard symbol and why is it necessary? The symbol shows a head and torso with a star radiating outward which is meant to signify the chemical presents a health hazard. Depending upon the chemical…… Personal Protective Equipment or PPE may be required. Whether or not PPE is required will be listed within the material's Safety Data Sheet, or SDS. Chemicals that are health hazards are broken into 4 groupings: MAY cause genetic defects; Have a potential to cause cancer; Have reproductive toxicity; May affect a single organ with single or repeated exposures, for example the lungs. Within the 4 groupings there are 3 levels for each. Chemicals MAY cause damage. Chemicals are SUSPECTED of causing damage. Chemicals WILL cause damage. Some examples of health hazards chemicals are lead which is used in industrial processes and paints, ceramics and piping; arsenic which is used in insecticides, wood preservation and in some medications for cancer; pyrethrin which is a common chemical in the treatment of lice; perfluorooctanoic acid, also known as PFOA, is used in electrical products and detergents.

Slide 13: "How To Read A GHS Label"

So now that all the categories have been discussed, it is important to talk about the labeling requirements. Each label requires that 6 sections be filled out. The first section includes a "signal word". This signal word will be either "warning" or "danger". Warning is for LESS severe hazards. Danger is for MORE severe hazards. The second section will be the pictograms or symbols. As you can see on this label there can be more than one pictogram displayed. The third section will contain the product name or some other identifier, in the case of this sample label it simply has the chemical

name. The fourth section has any hazard statements related to the chemical. It will contain at least one but often times there will be several. The code, an H, for hazard, followed by 3 numbers, MAY be listed but is not required. An example of an H code would be "H281 – contains refrigerated gas; may cause cryogenic burns or injury". The section may just contain the hazard statement. The fifth section will have all of the precautionary statements related to the hazard code. The precautionary code statements will have a P, for precautionary, followed by 3 numbers, the code MAY be listed but it is not required. The section may just contain the precautionary statements. These statements define how to handle and dispose of the chemicals as well as what to do in the case of an accidental spill. As an example, for any chemical that has a hazard statement of H281, the label will need to contain the following statements. P282, which is a prevention statement that says, "wear cold insulating gloves and either a face shield or eye protection". P336+P317 which is a response statement that says "Immediately thaw frosted parts with lukewarm water. Do Not rub affected area. Get medical help". P403 which is a storage statement that says, "Store in a well-ventilated place". The sixth section will contain the information of the manufacturer, their phone number and address and a CAS number. A CAS number is a number assigned to each unique chemical. A CAS number is the Chemical Abstracts Service (CAS) assigned to every chemical substance described in open scientific literature.

Slide 14: "Overview of GHS"

You now have a better understanding of the Globally Harmonized System of labeling and hazard identification. The system initially created by the UN, has been adopted by OSHA in the US as the required system of chemical identification. This information can be found in the Safety Data Sheets, or SDS manuals, many companies provide SDS to customers when they sell chemicals, as well as keeping the SDS publicly available on their website. SDS for household and other chemicals may be found online by searching the chemical name and the term SDS. For example, if you wanted to know the GHS information on bleach whose chemical name is sodium hypochlorite simply type "sodium hypochlorite SDS" in the search browser and scan through the SDS provided for varying concentrations of the chemical. It should be noted that changing a chemical concentration or mixture could alter the safety information provided.

Slide 15: "Example of a Safety Data Sheet (SDS)"

This is an example of a Safety Data Sheet or SDS. A company that uses this chemical would be required to maintain this SDS on-site. This sheet is for hydrofluoric acid. These 3 sheets are part of a longer 19-page document. The GHS symbols can be seen on the second sheet, as well as the precautionary statements.

Slide 14: "Examples of Consumer Product GHS Labels"

Thank you for listening to the Chemical Sector Risk Management Agency's informational webinar on the Globally Harmonized System of Classification and Labeling of Chemicals (GHS symbols). This slide leaves you with some examples of consumer products in the marketplace that have GHS symbols and hazard warnings. I encourage you to take a look around your home or workplace and better understand labeling on chemical products, this exercise can build your knowledge of chemical handling and safety and enhance your chemical security. As the Chemical Sector Risk Management Agency, CISA aims to lead the national effort to understand, manage, and reduce risk to the chemical sector. By participating in webinars like this one you are a valued partner in enhancing knowledge and

understanding across the sector which in turn aids to reduce and mitigate risk while enhancing resilience.

Slide 20 "Helpful Information"

This slide provides some helpful links, feel free to pause here and obtain these URLs for further detailed study. For further research into the variety of hazard codes, and precautionary statements the second link titled GHS classification, contains a plethora of detailed information about the various hazard codes and precautionary statements.

Slide 21: "For More Information (contact slide)"

For more information visit the URL on the screen which takes you to CISA's Chemical Sector page. If you have questions, please email us at ChemicalSector@CISA.DHS.GOV

Slide 22: "CISA Seal"

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