**Laboratory Hazard Assessment for Chemicals**

## Performing the Laboratory Hazard Assessment for Chemicals

To perform the assessment, take the following steps:

1. Familiarize yourself with the hazard categories used in the assessment (see **Hazard Categories and Risk Levels);**
2. Identify the hazard categories for each chemical (see **Identifying Hazard Categories)**;
3. Determine the total amount for each category (sum of the chemicals falling in that category) in the laboratory;
4. Use the table in **Hazard Categories and Risk Levels** to find the risk level for that category;
5. Log into the DRS webpage with your Net ID and Active Directory Password;
6. Go to “My Laboratory Info”, and click on “Hazards”;
7. Select the room for which you want to perform the assessment, and click the edit symbol on the right;
8. Under “Chemical Hazard Assessment”, click “yes” or “no” for each category depending on whether or not the hazard is present, and then select a risk level from the dropdown menu where available;
9. Click “Save” at the right bottom of the screen when the assessment is complete.

DRS will perform the initial Laboratory Hazard Assessment for Chemicals for laboratory groups that provide an inventory of applicable materials. An [inventory template](ChemicalInventoryTemplate.xlsx) with [instructions](InventoryInstructions.docx) is available.

**Updating the Assessment**

The PI or laboratory supervisor is responsible for updating the assessment when chemicals are added or removed from the laboratory. Evaluating the need for updates should be done at least annually. Contact DRS if you require assistance.

The display of biosafety levels and radioactive materials in the Hazard Profile reflects information from an Institutional Biosafety Committee registration or Radiation Permit. As such, this information can be updated only within those applications.

## Hazard Categories and Risk Levels

Chemicals are grouped into categories based on their physical and health hazards. Most of the chemical categories in the DRS laboratory hazard profile are based on the Globally Harmonized System (GHS), a new system of chemical hazard classification and labeling that was adopted by OSHA. [See Chemical Hazard Classification (GHS)](http://www.drs.illinois.edu/SafetyLibrary/ChemicalHazardClassification) for more information on GHS hazard categories, SDS organization, and label elements. The hazard assessment for chemicals focuses on the major chemical hazard categories that are most relevant for establishing safe work practices in a laboratory. Not all GHS hazard categories are captured.

The following GHS categories are included:

* Acutely toxic (severe);
* Health hazard (carcinogens, mutagens, reproductive toxins, target organ toxicity, and respiratory sensitizers);
* Corrosives;
* Flammable liquids;
* Flammable solids;
* Oxidizers;
* Pyrophorics;
* Water reactives;
* Explosive material;
* Compressed gases (inert, flammable, oxidizing, toxic, pyrophoric).

In addition, the following non-GHS chemical hazards are included:

* Cryogens;
* Nanomaterials;
* Peroxide-forming chemicals.

Based on the severity of the hazard and/or the amount used in the laboratory, each chemical hazard category is assigned a risk level of low, moderate, or high. The table below defines the risk levels for each category. Be aware that the risk levels indicate an overall assessment for materials in the laboratory. A “low” risk level does NOT mean that *use* of the chemical cannot pose a risk.

| **Hazard Category** | **Definition** | **Risk Level**  **LOW** | **Risk Level**  **MODERATE** | **Risk Level**  **HIGH** |
| --- | --- | --- | --- | --- |
| **Acutely Toxic Liquids and Solids** | Any substance that can cause minor or serious illness or death on exposure. These substances have a GHS classification of acute toxicity Cat 1-3 and are identified by the skull and crossbones pictogram. \*Due to the varying quantities of chemicals and their toxic effects, we do not define the risk level by quantities of acutely toxic chemicals. | N/A | Storage of Category 3 acute toxins. | Storage of Category 1 or 2 acute toxins. |
| **Compressed Gases – Inert** | Inert gases are non-toxic and non-flammable but pose hazards because they can displace oxygen, are highly pressurized, and can be extremely cold or cryogenic. The placard for non-flammable gas has a green background with white lettering. | N/A | N/A | Present in the lab? Yes/No |
| **Compressed Gases – Flammable** | A flammable gas is any material that is a gas at 20°C (68°F) or lower and is also ignitable when in a mixture of 13% or less by volume with air, or that has a flammable range with air of at least 12% regardless of lower limit. The placard for flammable gas has a red background with white lettering. | N/A | N/A | Present in the lab? Yes/No |
| **Compressed Gases – Oxidizing** | Oxidizing gas initiates or promotes combustion of materials, either by catching fire itself or by causing a fire through the release of oxygen or other gases. | N/A | N/A | Present in the lab? Yes/No |
| **Compressed Gases – Toxic** | Toxic gases are poisonous or can cause death. | N/A | N/A | Present in the lab? Yes/No |
| **Corrosives** | Corrosive materials are chemicals that cause visible destruction or irreversible alterations in living tissue by chemical action at the site of contact. | Storage of  < 10 L dilute (<1M) corrosive liquid.  < 5 L concentrated weak corrosive liquid.  < 100 g of corrosive solids. | Storage of  10-20 L dilute (<1M) corrosive liquid.  5-10 L concentrated weak corrosive liquids.  < 5 L concentrated strong corrosive liquids.  100 g -1 kg corrosive solids. | Storage of  > 20 L dilute (<1M) corrosive liquid.  > 10 L concentrated weak corrosive liquid.  ≥ 5 L strong corrosive liquids.  > 1 kg of corrosive solid. |
| **Cryogens** | Materials at ultra-low temperatures (< -73.3 °C) are considered cryogenic. Hazards include freezing of tissue, asphyxiation, toxicity, high pressure gas hazards, flammability, and explosion hazards. | Storage of small quantities (<5 L) of cryogens in well-ventilated areas. Examples: 1 gallon bucket use of dry ice. | Storage of moderate quantities (5-20 L) of cryogens in well ventilated areas. Examples: Use of a 10 L dewar of liquid nitrogen. | Storage of cryogens in excess of 20 L. Storage of cryogens that are toxic, highly flammable, or oxidizers. Examples: se of liquid oxygen. |
| **Explosive Materials** | Explosive substances are solids or liquids (or a mixture of substances) that are capable by a chemical reaction of producing gas at a temperature and pressure and at a speed to cause damage to the surroundings. Compounds classified as explosive, self-reactive, or organic peroxides fall under this category. They are labeled either with the explosive symbol or the flame symbol. | Chemicals that can be explosive in their pure form but that are shipped and stored in a stabilized form (e.g. wetted) and that are NOT labeled with the explosive symbol on the container. | Storage of < 100 g of material labeled with the explosive symbol. | Storage ≥ 100 g of material labeled with the explosive symbol. |
| **Flammable Liquids** | Flammable liquids have a flashpoint equal to or less than 200 °F. Most solvents are flammable and can cause irritation and defatting when in contact with skin. Inhalation of vapors can cause dizziness and a headache. Note: the low, moderate, and high storage quantities are based on a conservative interpretation of NFPA 45. If you use large quantities of flammable liquids, contact DRS for clarification. | Storage of flammable liquids less than 2 L/ 100 ft2. | Storage of flammable liquids in the range of 2-6 L/100 ft2. | Storage of flammable liquids > 6 L/100 ft2. |
| **Flammable Solids** | Flammable solids are solids that are readily combustible or that may cause or contribute to fire through friction. They can be easily ignited by brief contact with an ignition source, and the flame spreads rapidly. Pyrophorics and water-reactive solids will be captured in separate categories. | Category 2 flammable solids | Storage of less than 500 g of Category 1 flammable solid | Storage of ≥500 g Category 1 flammable solids. |
| **Health Hazards** | Compounds that are identified as mutagens, carcinogens, reproductive toxins, target organ toxins, or respiratory sensitizers. Under GHS, these compounds are identified by pictogram 1807 (“the exploding man”). Please note that this pictogram also describes other health hazards that do not fall under this category (e.g., aspiration hazard). | N/A | Compounds classified as carcinogen, mutagen, or reproductive toxin category 2. These compounds are suspected to cause carcinogenic tumors, genetic mutation, or reproductive defects | Compounds classified as carcinogen, mutagen, or reproductive toxin category 1a or 1b. These compounds are presumed or known to cause carcinogenic tumors, genetic mutation, or reproductive defects |
| **Nanomaterials** | Engineered materials on the nano-scale with any external dimension less than 100 nm that possess properties different than the bulk material. Biological materials such as proteins and DNA do not fall under this category. | Non-destructive use of nanomaterials that are bound in a solid matrix or gel or permanently bonded to a substrate with no potential for release. Example: using a glass slide with metal nano particles on the surface for optoelectronic measurements. | Use of nanomaterials suspended in solvents with potential for release as aerosols. Example: Sonication of an aqueous suspension of quantum dots. | Use of dry nanomaterials in the state of powders and pellets with high potential for release into air. Example: Weighing or transferring dry carbon nano tubes. |
| **Oxidizers – Liquids and Solids** | A chemical not necessarily combustible that can initiate or promote combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases. | Storage of < 100 g | Storage of 100 – 2000 g | Storage of > 2000 g |
| **Peroxide forming chemicals** | Chemicals susceptible to formation of explosive peroxides over time when exposed to light or oxygen. Depending on the explosion hazard of the peroxides formed, peroxide-forming chemicals are divided into 3 groups. | Storage of < 100 g listed under Category C. Storage of < 1000 g listed in Category B. | Storage of 100 g – 1000 g listed in Category C. Storage of ≥ 1000 g listed in Category B. | Storage of ≥1000 g listed under Category C. Storage of any amount listed under Category A |
| **Pyrophorics** | A gas, liquid, or solid that ignites spontaneously in air. | N/A | N/A | Use or storage of any quantity. |
| **Water Reactives** | Materials that react, sometimes violently, on contact with water, releasing toxic or flammable gas. | Storage of < 100 g | Storage of 100 – 1000 g | Storage of > 1000 g |

## Identifying Hazard Categories

## Information on the label

Labels that comply with GHS provide pictograms, signal words, and hazard statements that identify most of the hazard categories:

|  |  |  |  |
| --- | --- | --- | --- |
| Pictogram | Hazard Statement | Signal Word | Hazard Category |
|  |  |  | Corrosives |
|  |  |  | Oxidizers |
|  |  |  | Explosive Material (moderate/high) |
|  | **Fatal** if swallowed/in contact with skin/if inhaled |  | Acutely toxic (**1,2**) |
| **Toxic** if swallowed/in contact with skin/if inhaled |  | Acutely toxic (**3**) |
|  | May cause allergy or asthma symptoms or breathing difficulty if …  May cause genetic defects  May cause cancer  May damage the fertility or the unborn child  Causes damage to organs | **Danger** | Health Hazard (**1**) |
| Suspected of causing genetic defects  Suspected of causing cancer  Suspected of damaging the fertility or the unborn child  May cause damage to organs | **Warning** | Health Hazard (**2**) |
|  | Extremely/Highly flammable liquid and vapor |  | Flammable liquids |
| Catches fire spontaneously if exposed to air |  | Pyrophorics |
| In contact with water releases flammable gases  (which may ignite spontaneously) |  | Water reactives |
| Heating may cause a fire |  | Explosive Material (low) |
| Self-heating (in large quantities); may catch fire |  | Flammable Solid (1)  or flammable liquids |
| Flammable solid | **Danger** | Flammable solid (**1**) |
| Flammable solid | **Warning** | Flammable solid (**2**) |

## Information on Safety Data Sheets (SDS)

Some hazard information is not included on the label. The SDS should be consulted as a first resource to identify other hazard categories:

**Peroxide-forming chemicals** are identified by a statement in section 2 of the SDS.

The category **Nanomaterials** should be selected for solids or suspension with particles with at least one external dimension less than 100 nm.

If two different categories are listed for the same hazard category (e.g., carcinogen cat 1b and reproductive toxicity cat 2) list the higher hazard (lower number), i.e. select Health Hazard (1) in this case.

For chemicals that are purchased from vendors that do not yet provide GHS classification, the SDS for many chemicals can be referenced at Sigma-Aldrich. The hazard categories are found in section 2. If no GHS classification is available, make your best guess based on the information in the SDS. Contact DRS if you require assistance.

**Explosive Materials:** Some explosive or reactive chemicals are shipped wet or in a solution for safety reasons. The hazard classification on the label refers to the wetted chemical or mixture and does not always identify the reactivity of the dry/pure chemical. Read the SDS to determine if the chemical may be explosive or reactive.

**If any of the following are listed in the SDS, mark that chemical as Explosive Material:**

* A statement in section 2, "may explode when dry," or similar;
* A classification of the dry/pure chemical in section 2 or 3 as Explosive, Organic Peroxide, or Self Reactive.

The following *common* chemicals have explosive properties in their pure form:

|  |  |
| --- | --- |
| **Name** | **GHS Classification of the dry compound** |
| Ammonium Perchlorate | Explosives 1.1 |
| Azodicarbonamide (Azodicarboxamide or Azobisformamide) | Self-reactive E |
| Benzoyl Peroxide | Organic Peroxide B |
| Benzyl Azide | Self-reactive B |
| 1,1-Bis(tert-butylperoxy)-3,3,5-trimethylcyclohexane | Organic Peroxide B |
| Cellulose nitrate | Explosive 1.1 |
| 3-Chloroperbenzoic acid | Organic Peroxide D |
| Diazald | Self-reactive C |
| 1-Hydroxybenzotriazole | Flammable solid 2 |
| Picric acid | Explosive 1.1 |
| Tetraethylammonium perchlorate |  |
| tert-Butyl peroxybenzoate | Organic Peroxide C |
| 1,3,5-Trinitrobenzene | Explosive 1.1 |

**Note:**

The risk level “low” refers only to storage of the stabilized form and does NOT reflect the risks associated with handling such material or changes to the stability after storage for an extended period of time.