Objective: To identify carcinogenic chemical agents, learn the routes into the body, and find out how to protect yourself when handling them.

Area of application: laboratories and workshops in which carcinogenic chemical agents are handled.

What is a carcinogenic chemical agent? It is a substance or mixture of substances that induces cancer or increases its incidence.

Classifications:

**Category 1A**
Substances that are known to be carcinogenic, based on the existence of human evidence.

**Category 1B**
Substances that are known to be carcinogenic, based on the existence of animal evidence.

**Category 2**
Substances that are suspected of being carcinogenic for humans.
To identify carcinogenic chemical agents, consult the label and/or the safety data sheet (SDS)

Consult point 2 on the identification of hazards in the corresponding safety data sheet (SDS), which provides the information required to identify a carcinogenic chemical agent.

<table>
<thead>
<tr>
<th>Category</th>
<th>Pictogram</th>
<th>Signal word</th>
<th>Indications of hazards</th>
<th>H-phrase</th>
<th>R*-phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A or 1B</td>
<td>Danger</td>
<td>May cause cancer May cause cancer by inhalation</td>
<td>H350i</td>
<td>R45</td>
<td>R49</td>
</tr>
<tr>
<td>2</td>
<td>Warning</td>
<td>Suspected of causing cancer</td>
<td>H351</td>
<td>R40</td>
<td></td>
</tr>
</tbody>
</table>

* Special risks attributed to hazardous substances and preparations, according to RD 363/1995 and RD 255/2003
RESPIRATORY ROUTE

The route into the body of any chemical agent that is in the air in the form of a gas, vapour, fumes, powder, fibre, etc. that is taken into the lungs when the individual breathes in – inhales the surrounding air through the nose or mouth. Depending on the volume and shape of the particles, they will reach different distances along their passage through the respiratory system.

DERMAL ROUTE

The route for chemical agents that, when they come into contact with the skin, can cross it and reach the blood. The blood then distributes the chemicals around the body. Contact with eyes (irritation, etc.) is part of this route.

DIGESTIVE ROUTE

The route for chemical agents that involves their ingestion, generally due to involuntary action that is almost always associated with unhygienic practices and habits.

PARENTERAL ROUTE

The route for chemical agents through injuries to the skin or direct inoculation with the toxin.
Safety and hygiene regulations

Carcinogenic chemical agents

If the carcinogenic agent is replaced by another chemical agent, the risk of exposure is eliminated.

Generally, chemical agents that are carcinogenic do not have a universal replacement, but can be substituted in certain applications by other chemical agents that are not mutagenic or by alternative processes.

<table>
<thead>
<tr>
<th>Example CARCINOGEN IC chemical agent</th>
<th>Category</th>
<th>Applications</th>
<th>Alternative/Substitute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Carc. 1A Mutat. 1B</td>
<td>Laboratory analysis in industrial chemistry</td>
<td>- Anisole, cyclohexane, heptane, toluene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacture of other basic products in organic chemistry</td>
<td>- Toluene</td>
</tr>
<tr>
<td>Trichloroethyl</td>
<td>Carc. 1B Mutat. 2</td>
<td>General solvent for oils, wax, etc.</td>
<td>- Non-chlorinated organic solvents (hydrocarbons, alcohols, ketones, ethers and esters)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleaning of electrical equipment</td>
<td>- Solvent composed mainly of methoxynonafluorobutane</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>Carc. 2</td>
<td>Fixative for anatomical parts and tissues</td>
<td>- Glyoxal (ethane 1,2-dion), ethanol, polyvinyl alcohol, propylene glycol, ethanol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacture of printed circuits</td>
<td>- Sodium hypophosphate</td>
</tr>
</tbody>
</table>

For more information on potential substitutes, consult the INFOCARQUIM (INFOrmació sobre CARcinògens QUÍMics) database on the INSHT website: [http://infocarquim.insht.es:86/Forms/About.aspx](http://infocarquim.insht.es:86/Forms/About.aspx)
If the carcinogenic chemical cannot be replaced, observe the following preventive measures.

✓ Before handling the carcinogenic chemical:
  • Check the **relevant information** (hazards, precautions, etc.) on the **safety data sheet (SDS)** for the chemical.
  • Read and follow the health and safety measures on the SDS for the chemical.

✓ **Work with sealed equipment** to prevent exposure to carcinogenic chemicals due to accidental emissions at critical parts of the system (valves, joints, etc.).

✓ **Limit the amounts and concentrations** of the carcinogenic chemical to reduce exposure.

✓ **Limit the number of workers** who handle carcinogenic chemicals and reduce exposure time.

✓ **Delimit and signpost work areas** where carcinogenic chemicals are handled.

---

Danger! Carcinogenic chemicals in the work area

Chemical handled: benzene
If the carcinogenic chemical cannot be replaced, observe the following preventive measures.

- Handle carcinogenic chemicals in the fume cupboard to prevent the inhalation of vapours and aerosols.
- Use the following (minimum) personal protective equipment:
  - nitrile and/or neoprene chemical protection gloves to protect the skin,
  - safety goggles to protect the eyes.
  Consult the safety data sheet for the chemical to ensure the right PPE is used. If you have any queries, contact the manufacturer.
- Wear appropriate clothes (lab coat or similar) to prevent contaminating your street clothing. Do not wash work clothes at home. Use disposable lab coats or overalls as an alternative.
- Store carcinogenic chemicals in a chemical storage cabinet with access limited to authorised personnel.
- Health surveillance is compulsory for workers exposed to carcinogenic chemicals. Request a medical appointment by clicking on this link:
  https://www.upc.edu/prevencio/ca/salutupc

For more information on chemicals, consult the chemicals section on the Occupational Health and Safety website:
http://www.upc.edu/prevencio/ca/seguretat-higiene/productes-quimics