GENERAL SAFETY INSTRUCTION GSI-C-2

EXPLOSIVE ATMOSPHERES
1 INTRODUCTION

For the convenience of the reader, this General Safety Instruction uses the masculine gender only. However, its use shall be understood as referring to both genders unless the context clearly indicates a reference to one gender only.

1.1 Legal basis

In accordance with its intergovernmental status, the Organization establishes and updates Safety Rules to implement its Safety Policy.

This General Safety Instruction forms part of the CERN Safety Rules and is issued pursuant to the Staff Rules and Regulations and the CERN Safety Policy.

1.2 Purpose and scope

The purpose of this General Safety Instruction is to define the minimum Safety requirements to ensure the protection of persons from risks to their occupational health and safety arising, or likely to arise, from explosive atmospheres.

It applies to any CERN activity involving hazardous chemical agents where explosive atmospheres are present or may be present.

1.3 Definitions

For the purposes of this General Safety Instruction, the following definitions shall apply:

- **Component**: any item essential to the functioning of equipment and systems. In the context of this General Safety Instruction, a component is an essential item to the safe functioning of equipment and protective systems but with no autonomous function.

- **Equipment**: assembly of parts or components combined in whole to perform a work. In the context of this General Safety Instruction, an equipment is machines, apparatus, fixed or mobile devices, control components and instrumentation thereof and detection or prevention systems which, separately or jointly, are intended for the generation, transfer, storage, measurement, control and conversion of energy and/or the processing of material and which are capable of causing an explosion through their own potential sources of ignition.

- **Explosive atmosphere (ATEX)**: mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture.

- **Flammable substances**:
  - liquid substances and preparations having a flash point less than or equal to 55°C, or
  - solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or
  - gaseous substances and preparations which are flammable in contact with air at ambient temperature and pressure, or
  - substances and preparations which, in contact with water or damp air, evolve extremely flammable gases in dangerous quantities, at a minimum rate of 1 litre per kilogram per hour, or
  - substances that are spontaneously flammable in air, or
  - substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy, or
other substances which are not readily combustible or flammable under normal conditions, but which are explosive if the particle size is particularly small or the ignition energy is particularly high.

- **Hazardous area**: area in which special precautions are necessary to protect the occupational health and safety of persons. In the context of this General Safety Instruction, a hazardous area is an area in which an explosive atmosphere may occur.
- **HSE Unit**: organic unit competent in matters of occupational health and safety, fire and rescue preparedness and responses and environmental protection.
- **Laws**: laws, rules, regulations, ordinances, prescriptions, directives, standards and procedures issued by a national or international authority other than CERN or by a professional association or standardisation body.
- **Organic unit**: department or administratively assimilated unit and CERN Experiments.
- **Protective systems**: protective systems are devices other than components of the equipment which are intended to halt incipient explosions immediately and/or to limit the effective range of an explosion and which are separately placed on the market for use as autonomous systems (e.g. flame arrester, pressure release, bursting disc).
- **Work equipment**: equipment, protective system, components or any associated connecting devices.

For other definition please refer to Section 1.3 of Safety Regulation SR-C “Chemical agents”.

### 1.4 CERN Safety Rules and Laws

This General Safety Instruction is supplemented by the documents listed below, where they exist:

- Safety Regulations (SR);
- General Safety Instructions (GSI);
- Specific Safety Instructions (SSI);

and by the relevant provisions of the following Laws:

- European Standard IEC 60079 series: explosive atmospheres (Europe).
- European Standard EN 1127-1: explosive atmospheres – explosion prevention and protection (Europe).

In case of ambiguity or contradiction between the above-mentioned documents, they shall apply in decreasing order of priority, starting from the top.
2 MINIMUM SAFETY REQUIREMENTS RELATING TO EXPLOSIVES ATMOSPHERES

2.1 Risk assessment

Each organic unit concerned shall identify the activities under its responsibility where there is a risk arising from explosive atmospheres and carry out, for each such activity, a risk assessment taking into account in particular:

- the likelihood that explosive atmospheres will occur and the duration of their occurrence;
- the likelihood that ignition sources, including electrostatic discharges and sources of ionizing and electromagnetic radiation, will be present and become active and effective;
- the installations, substances used, processes, and their possible interactions;
- the scale of the anticipated effects.

Areas, which are or can be connected via openings to areas in which explosive atmospheres may occur, shall be included in the risk assessment. The risk assessment shall identify the location and extent of any hazardous areas, which shall be recorded in the Safety File.

2.2 Classification and identification of hazardous areas into ATEX zones

The hazardous areas shall be classified in terms of ATEX zones based on the frequency and duration of the occurrence of the explosive atmosphere (cf. 1999/92/EC, annex I) as established by the risk assessment:

<table>
<thead>
<tr>
<th>ATEX Zone</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A hazardous area in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.</td>
</tr>
<tr>
<td>1</td>
<td>A hazardous area in which an explosive atmosphere consisting of a mixture with air or flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.</td>
</tr>
<tr>
<td>2</td>
<td>A hazardous area in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.</td>
</tr>
<tr>
<td>20</td>
<td>A hazardous area in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.</td>
</tr>
<tr>
<td>21</td>
<td>A hazardous area in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.</td>
</tr>
<tr>
<td>22</td>
<td>A hazardous area in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.</td>
</tr>
</tbody>
</table>
The organic unit concerned shall ensure that these hazardous areas are marked at their points of entry with the following warning sign:

![Warning sign]

### 2.3 Explosion protection measures

#### 2.3.1 General principles

For each activity under its responsibility involving flammable substances, the organic unit concerned shall take technical and/or organizational measures in accordance with the following principles by order of priority:

- the prevention of the formation of explosive atmospheres, or where this is not possible,
- the avoidance of the ignition of explosive atmospheres, and
- the mitigation of the harmful effects of an explosion.

#### 2.3.2 Measures

For each activity involving flammable substances, the organic unit concerned shall ensure that the following minimum requirements are met:

- where the risk assessment reveals the need, work in hazardous areas is carried out in accordance with written instructions and/or is subject to specific training and permits;
- any ‘hot work’ in or near to a hazardous area is subject to the completion of the CERN fire permit by the person concerned;
- appropriate prevention and measures are in place;
- any escape and/or release, whether or not intentional, of flammable gases, vapours, mists or dusts which may give rise to explosion hazards are suitably diverted or removed to a safe place;
- installations or work equipment are only brought into service, if the organic unit concerned can demonstrate that they can be safely used in an explosive atmosphere;
- appropriate measures are in place to prevent confusion between connecting devices;
- appropriate measures are in place to minimise the risks to persons from the physical effects of an explosion and to control or minimise its propagation to zones in proximity to an ATEX zone;
- where the risk assessment reveals the need, persons are given optical and/or acoustic warnings and are withdrawn before explosion conditions are reached;
- prevention of ignition hazards also take account of electrostatic discharges, where persons or the working environment act as charge carrier or charge producer and, if such is the case, the persons concerned are provided with appropriate working clothes consisting of materials which do not give rise to electrostatic discharges that can ignite explosive atmospheres and with appropriate tools (i.e. avoid sparks);
- work in ATEX zones 0 and 20 is prohibited.
Where the risk assessment reveals the need, the organic unit concerned shall further ensure the possibility:

- of maintaining equipment and protective systems in a safe state of operation independently of the rest of the installation, where power failure can give rise to additional risks;
- for a competent person to manually override the shut-down of equipment and protective systems incorporated within automatic processes which deviate from the intended operating conditions, provided that this does not compromise safety;
- of dissipating accumulated energy as quickly and as safely as possible or isolating energy so that it no longer constitutes a hazard.

2.4 **Work equipment**

The organic unit concerned shall ensure that all work equipment used in hazardous areas has been demonstrably designed, constructed, assembled and installed, and is maintained and operated, in accordance with the manufacturer’s instructions and in such a way as to minimise the risks of an explosion.

Work equipment shall be selected taking into account the hazardous areas in which it can be used according to the categories and corresponding ATEX zones set out in Directive 2014/34/EU.

2.5 **Authorisation**

The first use, or use following a change in the risk, of a workplace containing hazardous areas shall be subject to authorization by the HSE Unit.

Authorization shall be granted if the overall explosion safety has been verified by the HSE Unit or by an external person whose competence in the field of explosion protection is recognized by the HSE Unit.

The organic unit concerned shall ensure that the conditions applying when safety authorization is granted are maintained.

2.6 **Purchase of flammable gases**

Any purchase of flammable gases is subject to prior authorization by the “Flammable Gas Safety Officer” (FGSO) concerned.

2.7 **Training**

For any activity under its responsibility where explosive atmospheres are present or may be present, the organic unit concerned shall ensure that, prior to accessing hazardous areas, suitable instructions and training are provided on the risk of explosion and explosion protection.

2.8 **Safety File**

For any activity under its responsibility where explosive atmospheres are present or may be present and in accordance with article 8 of the Directive 1999/92/EC, the organic unit concerned shall establish a Safety File and update it. The Safety File shall include the following documents:

- the results of the risk assessment including the applicable explosion protection measures and work equipment to be selected;
- classification of hazardous areas including identification of their location and extent;
- record of explosion protection measures;
- records of performance checks for all prevention and protection measures;
• design report, if applicable;
• technical specifications;
• manuals and files of conformity work equipment;
• special criteria, where applicable, for the selection of work equipment;
• documents and certificates relating to the procurement and commissioning of work equipment;
• records of executed maintenance and inspections;
• records of repairs and changes;
• evidence that the workplace and work equipment, including warning devices, are designed, operated and maintained with due regard for safety;
• authorisations;
• written instructions and permits issued for work in hazardous areas;
• qualification of person assessing explosion safety (cf. Section 2.5);
• authorization to purchase flammable gases;
• training records (trained persons and content of the training).

The documents making up the Safety File shall be written in English or French or in both languages and shall be submitted to the HSE Unit if the latter so requests.

3 FINAL PROVISIONS

3.1 Replacement of existing documents

This General Safety Instruction (version 2), including the applicable CERN Safety Rules and Laws (cf. Section 1.4), cancels and replaces General Safety Instruction GSI-C2 “Explosive atmospheres” (version 1).

3.2 Entry into force

This General Safety Instruction (version 2) enters into force upon its publication on the CERN website dedicated to the Safety Rules: https://www.cern.ch/safety-rules.