
Mining — Classification of mine accidents

Mines — Classification des accidents dans les mines

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 82, *Mining*.

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Introduction

The primary purpose of this document on classification of mine accidents is to promote uniformity and comparability of mine accidents statistics, which has as an ultimate goal to prevent accidents.

Although mine accidents are very complex realizations and many factors can contribute to their occurrence, much thought has been given to the study of causes and consequences of the accidents and many investigations have been carried out on the subject.

An accident, mishap or misadventure is an unforeseen and unplanned event or circumstance, often with lack of intention or necessity. It usually implies a generally negative outcome which might have been avoided or prevented.

A mine accident is an accident that occurs during the process of mining. Thousands of miners die from mine accidents every year. And although safer modern mining methods have been introduced, mine accidents are still the cause of casualties and financial losses.

Mine accidents can have a variety of causes, including leaks of poisonous gases such as hydrogen sulphide or explosive natural gases, especially firedamp or methane, dust explosions, collapsing of mine stopes, toxic gases arising from mine fires, mining-induced seismicity, flooding, or general mechanical errors from improperly used or malfunctioning mining equipment. Mine accidents mainly occur in the coal mining and underground mines sector. Initially, this document had a focus on coal and underground mines risks, but it has been extended to cover all mining environments.

While available accident reports are very detailed, this International Standard provides a tool to look at a broader picture. The advantage of the classification given in this International Standard is that statistical methods can be used to gain more insight into mine accident causation and probable results. By analysing a multitude of mine accidents and applying this standardized classification scheme, the users of this International Standard will be able to both detect patterns for the development of mine accidents and to derive correlations.

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Mining — Classification of mine accidents

1 Scope

This document establishes a classification of mine accidents by their origin or causes, by the type of accident, and by their results or consequences. The latter includes only the accidents resulting into consequences on people, not equipment or machinery.

Different categories of causes, types and consequences of mine accidents are briefly defined, and a 3-digit code is assigned to each category. These can be combined to ultimately allocate a unique 15-digit code to each type of mine accident. This code can then be used in statistical analysis. Similarly, an allocated code clearly shows to which categories of causes, type of accident and resulting consequences the mine accident belongs to.

This document is applicable to all surface and underground mines.

NOTE Accidents can be classified in terms of other items than those given in this document, especially in researches and in other classification schemes. These can be, e.g. classifications based on the level of financial damages; gender, age, professional skills, terms of service and academic degree of the personnel; days of week, month, year, hour of accident; area of site, etc. While these classifications can be useful to enable certain decisions to be taken by the health and safety executives, they are not considered in this document

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2 Normative references (standards.iteh.ai)

There are no normative references in this document.

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

accident

unplanned event that can result in injury or ill health of people, and/or damage to or loss of property, plants, materials, machinery, processes or the environment, and business opportunity

3.2

accident cause

factor or factors that act together to produce an accident

3.3

air blast

airborne shock wave or acoustic transient generated by an explosion

3.4

backfilling

filling in again of a place from which the rock or ore has been removed

3.5

blocking

obstruction of the ore passes by ore material or rock that refuses to pass

3.6

brattice curtain **line brattice**

line canvas

line curtain

fire-resistant fabric or plastic partition used in a mine passage to confine the air and force it into the working place

3.7

detonation

explosion where the shock waves are supersonic

Note 1 to entry: Detonation involves a supersonic exothermic front accelerating through a medium that eventually drives a shock front propagating directly in front of it.

Note 2 to entry: Detonations are observed in both conventional solid and liquid explosives, as well as in reactive gases. The velocity of detonations in solid and liquid explosives is higher than that in gaseous ones, which allows the wave system to be measured with greater detail.

3.8

dust

fine particles of a solid that can remain suspended in air with a particle size larger than that of a fume

Note 1 to entry: Dusts are produced by mechanical action, such as grinding.

Note 2 to entry: Some dusts can be harmful to an employee's health.

3.9

dust explosion

fast combustion of dust particles suspended in the air in an enclosed location

Note 1 to entry: Coal dust explosions are a frequent hazard in underground coal mines, but dust explosions can occur where any powdered combustible material is present in an enclosed atmosphere or, in general, in high enough concentrations of dispersed combustible particles in atmosphere or other suitable gaseous medium such as molecular oxygen.

3.10

explosive

chemical which detonates after introduction of a stimulus appropriate initiation, so that the reaction front moves through the explosive at a higher speed than the sonic velocity of the material

Note 1 to entry: Upon detonation, an explosive releases large volumes of gaseous products and energy on the surrounding rock, which causes fragmentation, shattering, or shearing.

Note 2 to entry: The ingredients of an explosive, which are combinations of fuels and oxidizers, are converted to high pressure, high temperature gases upon detonation.

3.11

face

exposed area of a working place from which a mineral, rock, ore or coal is being extracted

3.12

failure

<of rocks> rock instability occurring when applied force exceeds maximum rock strength

3.13

failure

<of objective> state or condition of not meeting a desirable or intended objective

3.14

fly rock

fugitive rock fragments propelled from the blast area by the force of an explosion

3.15**injury**

damage to a biological organism caused by physical harm

3.16**noise**

unwanted sound that can lead to hearing loss or stress, or to interfere with the ability to hear other sound or to communicate

3.17**outburst**

violent evolution of combustible gases (usually together with large quantities of coal dust) from a working face

Note 1 to entry: The occurrence is violent and can overwhelm the workings and fill the entire district with gaseous mixtures.

Note 2 to entry: Roadways advancing into virgin and stressed areas of coal are particularly prone to outbursts in certain seams and faults often intersect in the area.

3.18**rock burst**

sudden and often violent breaking of a mass of rock from the walls of a tunnel, mine, or deep quarry, caused by failure of highly stressed rock and the rapid or instantaneous release of accumulated strain energy

3.19**roof fall**

mine cave-in, especially in permanent areas such as entries

3.20**spalling**

violent formation of slabs which separate from a strained surface

Note 1 to entry: If the force is sufficient for the slab to be ejected from the surface this would constitute one form of strainburst.

3.21**stowing**

debris of a vein thrown back from a continuous miner machine and which supports the roof or hanging wall of the excavation

4 Classification**4.1 General**

This document defines three major categories to classify mine accidents. As shown in [Figure 1](#), one category is the origin or cause of mine accidents, the second one is the type of accidents and the third one is their resulting consequences. In this regard, all mine accidents can be placed into the categories, given in [4.2](#) to [4.4](#).

4.2 Classification of mine accidents based on their origin or cause

This category comprises the following mutually exclusive sub-categories:

- Chemical-based accidents (see [5.1](#))
- Electrical-based accidents (see [5.2](#))
- Environmental-based accidents (see [5.3](#))

- Geo-chemical-based accidents (see [5.4](#))
- Geo-mechanical-based accidents (see [5.5](#))
- Equipment-based accidents (see [5.6](#))
- Mechanical-based accidents (see [5.7](#))
- Human errors-based accidents (see [5.8](#))

4.3 Classification of mine accidents based on type of accident

This category comprises the following mutually exclusive sub-categories:

- Contact with objects and equipment (see [6.1](#))
- Falls (see [6.2](#))
- Bodily reaction and exertion (see [6.3](#))
- Exposure to harmful substances or environments (see [6.4](#))
- Fires and explosions (see [6.5](#))
- Unclassifiable (see [6.6](#))

4.4 Classification of mine accidents based on their consequences

This category comprises the following mutually inclusive sub-categories:

- Degree of disability (see [7.1](#))
- Nature of injury (see [7.2](#))
- Location of injury (see [7.3](#))

4.5 Coding

A unique combined code in the form of “**1xx.2xx.3xx.4xx.5xx**” can then be allocated to any accident, where:

“**1xx**” is for the origin or cause of the accident.

“**2xx**” is for the type of accident.

“**3xx**” is for its consequences by degree of disability.

“**4xx**” is for its consequences by nature of injury.

“**5xx**” represents its consequences by part of the body injured.

EXAMPLE Code “194.292.311.409.517” shows that the origin of the accident is “Errors caused by violating procedures, instructions and regulations”, type of accident is “Explosion”, degree of disability is “Death”, the nature of injury is “Burns” and location of injury is “Head, multiple locations”.

[Clause 5](#) describes the codes for the origin or cause of the accident, [Clause 6](#) describes the codes for the type of accident, and [Clause 7](#) describes the codes for the consequences of the accident by degree of disability ([7.1](#)), by nature of injury ([7.2](#)) and by part of the body injured ([7.3](#)). [Annex A](#) gives a complete list of the codes.

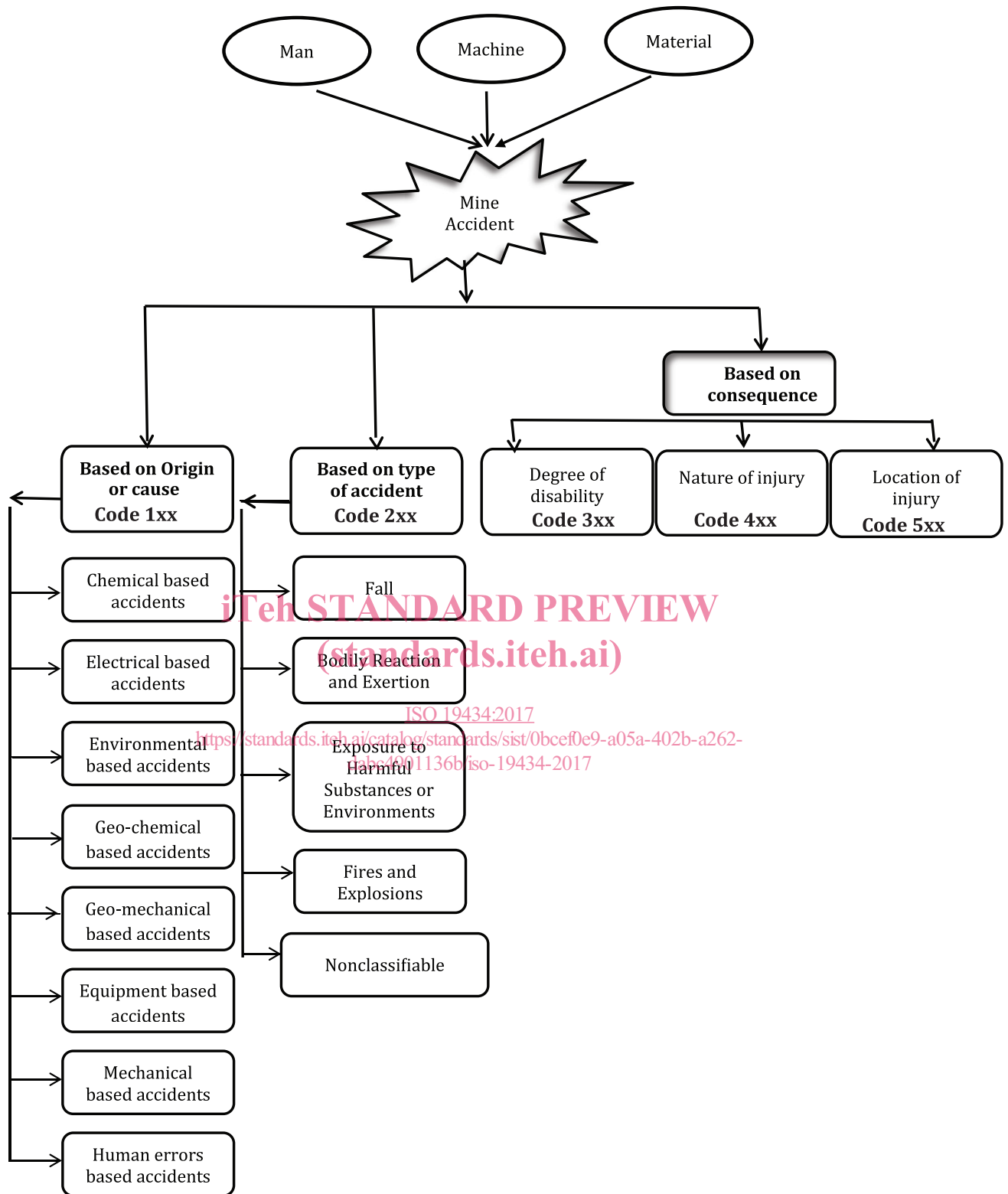


Figure 1 — Classification of mine accidents

5 Classification of mine accidents based on their origin or cause: Code 1xx

5.1 Chemical-based accidents: Code 10x, unspecified is 100

5.1.1 Explosives and accessories: Code 101

Accidents involving the detonation of manufactured explosives that can cause unbalancing oxygen, flying debris, fly rock, concussive forces and fumes are included in this category.

These accidents can occur during blasting operations, charging, handling and withdrawing charges.

5.1.2 Chemical compounds: Code 102

In this category, chemical compounds such as acids and alkalis are most directly tied to the resulting accident and injury.

5.1.3 Fire: Code 103

Accidents classified in this group are caused by fire accidents. Fires include:

- a) Open fires, which result from friction, welding, firing, gas explosion and cable short circuiting.
- b) Spontaneous combustion: in this process, charcoal temperature increases due to oxygen surface absorption and causes an increase in chemical reactions and the production of carbon monoxide, carbon dioxide, methane, hydrogen and various carbohydrates. In case of oxygen sufficiency and lack of an efficient ventilation system to transmit the resulted heat, spontaneous combustion and eventually fire occur in the mine. The events relating to spontaneous combustions are classified in [subclause 5.4](#).

5.1.4 Chemical apparatus and material: Code 104

The events classified in this group are caused by defective or broken equipment and chemicals used in mines, such as: failure of the brattice curtain (plastic and canvas) and catalytic heating equipment and damage of rubber/plastic/fibreglass/fabric material.

5.2 Electrical-based accidents: Code 110

In this category, electric current (DC or AC) is most directly responsible for the resulting accident.

Electrical energy is used in mines in four settings: lighting (lights), power distribution network (cables), electrical mining machines such as ventilation machines, and electric shot firing. Accidents occurring in these four settings are classified in this group.

5.3 Environmental-based accidents: Code 12x, unspecified is 120

Mining accidents in this group occur due to working and natural environment conditions.

5.3.1 Working environment: Code 121

Conditions occurring due to mining operations and construction activities, such as inrush of water and mud, audio contamination, slippery surfaces or geographical topology such as ponds and lakes or stuck in facilities.

Conditions related to the environmental situation of the workplace such as temperature and pressure, diesel particulate matter (DPM), fog, disturbing animals, and light intensity.