INTERNATIONAL STANDARD

ISO 19434

First edition
2017-10

Mining — Classification of mine accidents

Mines — Classification des accidents dans les mines

Reference number
ISO 19434:2017(E)

© ISO 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ... **v**

Introduction ... **vi**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Classification ... **3**
4.1 General ... 3
4.2 Classification of mine accidents based on their origin or cause ... 3
4.3 Classification of mine accidents based on type of accident ... 4
4.4 Classification of mine accidents based on their consequences ... 4
4.5 Coding ... 4

5 Classification of mine accidents based on their origin or cause: Code 1xx ... **6**
5.1 Chemical-based accidents: Code 10x, unspecified is 100 ... 6
5.1.1 Explosives and accessories: Code 101 ... 6
5.1.2 Chemical compounds: Code 102 ... 6
5.1.3 Fire: Code 103 ... 6
5.1.4 Chemical apparatus and material: Code 104 ... 6
5.2 Electrical-based accidents: Code 110 ... 6
5.3 Environmental-based accidents: Code 12x, unspecified is 120 ... 6
5.3.1 Working environment: Code 121 ... 6
5.3.2 Natural environment: Code 122 ... 7
5.4 Geo-chemical-based accidents: Code 130 ... 7
5.5 Geo-mechanical-based accidents: Code 140 ... 7
5.6 Equipment-based accidents: Code 15x, unspecified is 150 ... 7
5.6.1 Hand tools: Code 151 ... 7
5.6.2 Non-powered haulage: Code 152 ... 7
5.6.3 Powered haulage: Code 153 ... 7
5.6.4 Hoisting: Code 154 ... 7
5.6.5 Machinery: Code 155 ... 8
5.7 Mechanical-based accidents: Code 160 ... 8
5.8 Human errors-based accidents [4] ... 8
5.8.1 General ... 8
5.8.2 Person-based errors: Code 17x, unspecified is 170 [4] ... 8
5.8.3 Situation-based errors: Code 18x, unspecified is 180 [4] ... 9
5.8.4 System-based errors: Code 19x, unspecified is 190 [4] ... 9

6 Classification of mine accidents based on type of accident: Code 2xx, unclassifiable is 200 [1] ... **10**
6.1 Contact with objects and equipment: Codes 210 (for unspecified), 22x, 23x, 24x or 25x [1] ... 10
6.1.1 Struck against object: Code 22x, unspecified is 220 ... 10
6.1.2 Struck by object: Code 23x, unspecified is 230 ... 10
6.1.3 Caught in or compressed by equipment or objects: Code 24x, unspecified is 240 ... 11
6.1.4 Caught in or crushed in collapsing materials: code 25x, unspecified is 250 ... 12
6.2 Falls: Code 26x, unspecified is 260 [1] ... 12
6.2.1 Fall of person to lower level: Code 261 ... 12
6.2.2 Falls of persons on the same level: Code 262 ... 12
6.2.3 Fall of material or structures: Code 263 ... 12
6.3 Bodily reaction and exertion: Code 27x, unspecified is 270 [1] ... 13
6.3.1 Over-exertion in lifting objects: Code 271 ... 13
6.3.2 Over-exertion in pushing or pulling objects: Code 272 ... 13
6.3.3 Over-exertion in handling or throwing objects: Code 273 ... 13

© ISO 2017 – All rights reserved

6.3.4 Wrong movements: Code 274 ... 13
6.4 Exposure to harmful substances or environments: Code 28x, unspecified is 280 [1] ... 13
6.4.1 Contact with electric current: Code 281 ... 13
6.4.2 Contact or exposure to temperature extremes: Code 282 ... 13
6.4.3 Exposure to noise: Code 283 ... 13
6.4.4 Exposure to radiation: Code 284 ... 13
6.4.5 Oxygen deficiency: Code 285 ... 13
6.4.6 Contact with chemicals: Code 286 ... 14
6.5 Fires and explosions: Code 29x, unspecified is 290 [1] ... 14
6.5.1 Fires- unintended or uncontrolled: Code 291 ... 14
6.5.2 Explosion: Code 292 ... 14
6.6 Unclassifiable: Code 200 [1] ... 14

7 Classification of mine accidents based on their consequences: Codes 3xx, 4xx and 5xx ... 14
7.1 Based on the degree of disability: Code 3xx, unspecified is 300 [3] ... 14
7.1.1 Resulting in death or disability, Code 31x ... 14
7.1.2 Without disability: Code 32x, unspecified is 320 ... 15
7.2 Based on the nature of injury: Code 4xx, unspecified is 400 [5] ... 15
7.2.1 Fractures: Code 401 ... 15
7.2.2 Dislocations: Code 402 ... 15
7.2.3 Sprains and strains: Code 403 ... 15
7.2.4 Concussions and other internal injuries: Code 404 ... 15
7.2.5 Amputations and enucleations: Code 405 ... 15
7.2.6 Other wounds: Code 406 ... 15
7.2.7 Superficial injuries: Code 407 ... 16
7.2.8 Contusions and crushings: Code 408 ... 16
7.2.9 Burns: Code 409 ... 16
7.2.10 Acute poisonings: Code 410 ... 16
7.2.11 Effects of weather, exposure and related conditions: Code 411 ... 16
7.2.12 Asphyxia: Code 412 ... 16
7.2.13 Effects of electric currents: Code 413 ... 16
7.2.14 Effects of radiations: Code 414 ... 16
7.2.15 Multiple injuries of different nature: Code 415 ... 16
7.2.16 Others and unspecified injuries: Code 400 ... 17
7.3 Based on location of injury: Code 5xx, unspecified is 500 [5] ... 17

Annex A (informative) **Code list ... 19**

Bibliography ... 25

 © ISO 2017 – All rights reserved

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

© ISO 2017 – All rights reserved

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.

© ISO 2017 – All rights reserved

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

2 Normative references

There are no normative references in this document.

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

© ISO 2017 – All rights reserved

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

© ISO 2017 – All rights reserved

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)

© ISO 2017 – All rights reserved