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Safety aspects — Guidelines for child safety in standards and other specifications

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National foreword

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) are worldwide federations of national standards bodies (ISO member bodies and IEC national committees). The work of preparing International Standards is normally carried out through ISO and IEC 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 or IEC, also take part in the work. ISO collaborates closely with IEC on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

Draft Guides adopted by the responsible Committee or Group are circulated to the member bodies for voting. Publication as a Guide requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC Guide 50 was prepared by a Joint Working Group of the ISO Committee on Consumer Policy (COPOLCO) and the IEC Advisory Committee on Safety (ACOS). This third edition cancels and replaces the second edition (ISO/IEC Guide 50:2002), which has been technically revised.

The main changes compared with the second edition are as follows:

— close alignment of the title and scope with the title and scope of ISO/IEC Guide 51;

— additional clarification that ISO/IEC Guide 50 is intended for standards developers, but that it can also be used by other stakeholders;

— expansion of Clause 5 outlining the relationship between child development, behaviour and unintentional harm;

— new structure of Clause 7 on hazards, and inclusion of new hazards that were not included in the previous edition;

— addition of new Clause 8 dealing with the adequacy of safeguards.

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Introduction

0.1 Intended users of this Guide

This Guide provides guidance to those developing and revising standards, specifications and similar publications. However, it contains important information that can be useful as background information for, amongst others, designers, architects, manufacturers, service providers, educators, communicators and policy makers.

This Guide provides useful information for auditors and safety inspectors in the absence of a specific standard.

0.2 The reason for this Guide

Preventing injuries is a shared responsibility. The challenge is to develop products, including manufactured articles, including their packaging, processes, structures, installations, services, built environments or a combination of any of these which minimize the potential for causing deaths or serious injuries to children. A significant aspect of this challenge is to balance safety with the need of children to explore a stimulating environment and learn. Injury prevention can be addressed through design, engineering, manufacturing controls, legislation, education and raising awareness.

0.3 Relevance of child safety

Child safety is a major concern for society, because child and adolescent injuries are a major cause of death and disability in most countries. The joint WHO/UNICEF *World Report on Child Injury Prevention* [26] identifies unintentional injury as the leading cause of death for children over the age of 5. More than 830 000 children die each year from road traffic crashes, drowning, burns, falls and poisoning.

Children are born into an adult world, without experience or appreciation of risk, but with a natural desire to explore. They can use products or interact with environments in ways not necessarily intended, which are not necessarily regarded as “misuse”. Consequently, the potential for injury is particularly great during childhood. Supervision might not always prevent or minimize significant injury. Therefore, additional injury prevention strategies are often necessary.

Intervention strategies aimed at protecting children recognize that children are not little adults. Children’s susceptibility to injury and the nature of their injuries differ from those of adults. Such intervention strategies ideally also consider reasonably foreseeable use of products or surroundings. Children interact with them in ways that reflect characteristics of child behaviour, which will vary according to the child’s age and level of development. Intervention strategies intended to protect children therefore often differ from those intended to protect adults.

0.4 Role of standards

Standards can play a key role in reducing and preventing injury because they have the unique potential to:

— draw on technical expertise for design, manufacturing controls and testing,

— specify critical safety requirements, and

— inform through provisions for instructions, warnings, illustrations, symbols, etc.

NOTE In this Guide, the term “standard” includes other ISO/IEC publications, e.g. Technical Specifications and Guides.

0.5 Structure of this Guide

This Guide provides additional information to ISO/IEC Guide 51. Whereas ISO/IEC Guide 51 provides a structured approach to risk reduction within a general safety context, this Guide focuses on the

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relationships between child development and harm from unintentional injury, and provides advice on addressing hazards that children might encounter. This Guide is structured as follows:

a) Clause 4 describes a general approach to child safety, including the principles for a systematic way to address hazards;

b) Clause 5 covers the relationship between child development and behaviour and unintentional injury, including children's anthropometry (see 5.1.2), motor (see 5.1.3), physiological (see 5.1.4) and cognitive (see 5.1.5) development, and exploration strategies (see 5.1.6); the importance of applying knowledge of child development to preventing harm is covered in 5.2; children's development age compared with chronological age is covered in 5.3;

c) Clause 6 covers the relevance of the child's physical and social environments and special considerations relating to the child's sleeping environment;

d) Clause 7 describes hazards to which children might be exposed during their use of, or interaction with, a product, along with specific suggestions for addressing those hazards;

e) Clause 8 describes a structured means of considering the adequacy of safeguards.

In addition, Annex A contains a checklist for assessing a standard. It provides an overview of hazards, potential injuries and structured approaches to solutions. However, it is essential that it be read in conjunction with the main body of this Guide, as it only gives a few examples of structured approaches. Annex B lists some information on injury databases.

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Safety aspects — Guidelines for child safety in standards and other specifications

1 Scope

This Guide provides guidance to experts who develop and revise standards, specifications and similar publications. It aims to address potential sources of bodily harm to children from products that they use, or with which they are likely to come into contact, even if not specifically intended for children.

This Guide does not provide guidance on the prevention of intentional harm (e.g. child abuse) or non-physical forms of harm, such as psychological harm (e.g. intimidation).

This Guide does not address the economic consequences of the above.

NOTE The term "product" is defined in 3.5.

2 Normative references

There are no normative references.

3 Terms and definitions

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

3.1
carer
person who exercises responsibility, however temporarily, for an individual child's *safety* (3.7)

Note 1 to entry: A carer is sometimes referred to as a "caregiver".

EXAMPLE Parents; grandparents; siblings who have been given a limited responsibility over a child; other relatives; adult acquaintances; babysitters; teachers; child-minders; youth leaders; sports coaches; camp counsellors; day care workers.

3.2
child
person aged under 14 years

Note 1 to entry: Ages may vary according to local legislation; some standards may use different age limits.

Note 2 to entry: See 4.2 for more information.

3.3
harm
injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1]

3.4
hazard
potential source of *harm* (3.3)

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

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3.5
product
manufactured article, process, structure, installation, service, built environment or a combination of any of these

Note 1 to entry: In the case of consumer goods, packaging (whether or not it is intended or likely to be retained as part of the product) is considered an integral part of the product (see also 7.1).

3.6
risk
combination of the probability of occurrence of *harm* (3.3) and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified — Note 1 to entry has been deleted.]

3.7
safety
freedom from *risk* (3.6) which is not tolerable

[SOURCE: ISO/IEC Guide 51:2014, 3.14]

3.8
tolerable risk
level of *risk* (3.6) that is accepted in a given context based on the current values of society

[SOURCE: ISO/IEC Guide 51:2014, 3.15, modified — Note 1 to entry has been deleted.]

4 General approach to child safety

4.1 General

When developing or revising a standard for a product, standards developers should consider if and how children are likely to interact with the products the standard is addressing, regardless of whether those products are aimed specifically at children. The safety concepts that distinguish child safety from safety in general are explained in this clause. These concepts are additional to the contents of ISO/IEC Guide 51.

4.2 Age descriptors used in this Guide

A number of age related terms referencing child development are in common use. They are not mutually exclusive and, depending on context, may be used loosely or with precise meaning, as follows.

— The terms “babies” or “infants” usually refer to those not yet walking.

— The term “toddlers” usually refers to children who can walk, but whose ambulatory skills are not fully developed and exhibit strong exploratory behaviour.

— The term “young children” often refers to those past the toddler stage, but still developing basic skills, such as those aged 3 to 8 years. They are likely to have well-developed gross motor skills, are beginning to perform some basic adult tasks, and are gradually subject to less supervision, but their behaviour might still be impulsive and unpredictable. It is important to remember that there will be significant differences between the skills and behaviours of children at the extremes of this age range.

— The term “older children” refers to those who are not yet adolescents: the upper age limit can vary, so the term can refer to those from approximately age 9 to age 12, 13 or 14. It is an age group that is increasingly independent, is capable of performing most adult tasks (albeit with varying degrees of competence) although they might still not act consistently and predictably, might react to peer pressure, and might not fully understand the consequences of their actions. It is a period when there can be an emotional conflict of wanting both security and independence. At the upper end of this age group, children have a strong drive for independence and are likely to seek new experiences.

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4.3 Risk assessment

Risk assessment is an important step in any injury prevention strategy. It is critical to identify all events or event chains that could result in harm for each hazard.

A general approach is outlined in ISO/IEC Guide 51, which defines the risk associated with a particular hazardous situation as a function of the severity of harm that can result from the hazard, and the probability of occurrence of that harm. Severity of harm and, in particular, probability of occurrence, should be objectively determined and based on relevant facts that demonstrate causation, instead of arbitrary and intuitive decision-making. When addressing child safety, the following factors need special attention related to the risks for children:

a) their interactions with persons and products;

b) their development and behaviour;

c) degree of awareness, knowledge and experience of child and carer;

d) social, economic, and environmental factors; likelihood of being injured related to their physical characteristics and behaviour;

e) degree of supervision by carer.

4.4 Preventing and reducing harm

4.4.1 Harm can result from hazards such as deprivation of vital needs, (e.g. oxygen, such as by drowning or suffocation), transfer of energy (e.g. mechanical, thermal, electrical, radiation), or exposure to agents (e.g. chemical, biological) greater than the body's capacity to withstand (see Clause 7). It can be prevented or reduced by intervening in the chain of events leading to, or following, their occurrence. Designing safe products generally results in primary prevention.

4.4.2 Strategies may include one or more of the following:

— eliminating the hazard and/or exposure to the hazard (primary prevention, e.g. designing safer products); for example, substituting non-flammable liquid for a flammable one);

— eliminating exposure to the hazard (primary prevention);

— reducing the probability of exposure to the hazard (secondary prevention, e.g. using child-resistant packaging);

— reducing the severity of harm (secondary prevention, e.g. use of personal protective equipment or reduction of temperature of domestic hot water);

— reducing the long-term effects of harm through approaches such as rescue, treatment or rehabilitation (tertiary prevention).

NOTE An approach to risk reduction is also presented in ISO/IEC Guide 51:2014, 6.3.

4.4.3 In addition, strategies can be passive or active. Passive strategies work without the individual having to take any action to be protected, whereas active strategies require the individual to take some action to minimize the harm. Passive strategies that eliminate or guard against a hazard ensure a greater likelihood of success than active strategies.

Improving product safety, i.e. eliminating or minimizing risks that may lead to significant injuries, should start at the product design stage, aiming to incorporate a primary prevent approach or, if this is not possible, a secondary prevent approach. Secondary prevention can include the provision of

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information for users about residual risks, those that might have to be addressed by users. Whenever possible, product design should aim to incorporate passive prevention strategies.

NOTE An approach to risk reduction is also presented in ISO/IEC Guide 51:2014, 6.3.

Various sources can be used to identify the potential for harm associated with a product. These include, but are not limited to:

— injury statistics;

— detailed information available from injury surveillance systems;

— research results;

— test data (although passing a test does not necessarily mean a product is free of hazards);

— investigations of case reports;

— complaint data;

— extrapolation of relevant data about hazardous characteristics from other types of products. Surveillance data, recalls, and other similar actions in other jurisdictions should be considered.

CAUTION — The absence of reported harm does not necessarily mean that there is no hazard.

As harm to children is generally closely related to their developmental stage and their exposure to hazards at various ages, it is important to sort child injury data by age group to identify the patterns that emerge.

EXAMPLE 1 The number of burns from oven doors, scalds, poisoning by medicines and household chemicals, and drowning peaks among children under 5 years of age.

EXAMPLE 2 Injuries associated with falls from playground equipment peak at 5 to 9 years.

EXAMPLE 3 Injuries associated with falls and impacts related to sports peak at 10 to 14 years.

The identification of countermeasures results from research and evaluation, particularly based on injury data, child behaviour, engineering and biomechanics. Feedback, e.g. from consumers, can provide valuable information about the need to redesign products.

When choosing preventive measures, it is important to recognize that tolerable risk for adults might not apply to children. When introducing measures designed to protect adults it is essential to consider increased and/or additional risks for children (e.g. passenger side air bags in cars).

Further information on injury surveillance systems is given in Annex B.

4.5 The "invisibility" of children

4.5.1 Children are "invisible", i.e. their presence is difficult to detect, for several reasons:

— their small body size makes them less visible to adults;

— their lack of judgment to understand dangers and their unpredictable behaviour can place them in hazardous situations that adults do not anticipate.

4.5.2 Human eyesight has limitations, such as limits in peripheral vision. Children out of the field of vision of adults are at risk of being involved in serious accidents. For example:

— a child near a vehicle might be in the driver's blind spot and be inadvertently hit by the vehicle;

— a child might jump out in front of a moving vehicle and be hit;

— a child might not be visible when another person opens or closes a door.

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4.5.3 Possible strategies to avoid or alleviate risks in blind spots should be considered, for example:

— preventing children from entering high-risk locations, such as driveways, by installing barriers or swing-arm barriers to prevent them from crossing in front of a school bus without being seen by the bus driver;

— eliminating blind spots on a vehicle by mounting a mirror or recognition system;

— extending a transparent window in a door to a lower level.

4.6 Needs of children with disabilities

A small but significant proportion of children have disabilities. Some children are born with a disabling health condition or impairment, while others experience disability as a result of illness, injury or poor nutrition. A number of children have a single impairment while others experience multiple impairments. For example, a child with cerebral palsy might have mobility, communication and intellectual impairments. The complex interaction between a health condition or impairment and environmental and personal factors means that each child's experience of disability is different.

IMPORTANT — For these reasons, advice from specialists should be sought.

For children with disabilities, requirements to meet their needs, in addition to those outlined in this Guide, might be appropriate, although there might be situations when generic approaches are not possible and individual approaches are required.

The term "disabilities" includes a wide range of conditions, varying in their nature, severity and impact. Disabilities include, but are not limited to:

— behavioural and learning impairments;

— physical and growth impairments;

— sensory impairments;

— motor skill impairment.

This Guide does not provide detailed advice on how to minimize the risk and/or severity of unintentional injuries among children with disabilities.

NOTE ISO/IEC Guide 71 addresses the needs of persons with disabilities in broad terms, but does not specifically cover guidance relating to children with disabilities.

5 Safety considerations: child development, behaviour, and unintentional harm

5.1 Child development and behaviour

5.1.1 General

Children are not small adults. Inherent characteristics of children, including their stage of development, together with their exposure to hazards, puts them at risk in ways different from adults. Developmental stage broadly encompasses children's size, shape, physiology, physical and cognitive ability, emotional development and behaviour. These characteristics change quickly as children develop. Consequently, parents and other carers often overestimate or underestimate children's abilities at different stages of development, thus exposing them to hazards. This situation is compounded by the fact that much of the environment that surrounds children is designed for adults.

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All the childhood characteristics described in this section need to be considered in determining potential hazards associated with products. Keep in mind these characteristics can act in combination, increasing the child's risk. For example:

— exploratory behaviour might lead a child to climb a ladder;

— limited cognitive skills might prevent the child from recognizing that the ladder might be too high or unstable;

— limited motor control might result in the child losing grip and falling.

The way children use and interact with products should be considered normal childhood behaviour. The term "misuse" is misleading, and can lead to inappropriate decision-making regarding child hazards. Survey evidence shows that children regularly use products that were not designed for them, such as microwave ovens. When a child interacts with a product, it is difficult to make a distinction between play, active learning or intended use. For safety reasons, it is not constructive to attempt to distinguish between such interactions.

Safety considerations should provide an appropriate balance between risk and freedom for children to explore a stimulating environment and to learn. The goal is to reduce the risk of harm by design in accordance with their level of development.

5.1.2 Children's body size and anthropometric data

Certain characteristics of children's size and weight distribution make them particularly vulnerable to harm. The nature of this harm might also be different from that experienced by adults.

Children's size in relation to their surroundings makes it necessary to examine their anthropometry, including overall heights as well as body part lengths, widths and circumferences. Anthropometric data should be consulted in order to establish the normal distribution and safety margins. Children, like adults, do not necessarily have consistent measurements for different parts of their bodies. For example, a child measuring in the 95th percentile in height may have a head that is in the 50th percentile and hand length in the 25th percentile. Children within an age group can have major differences in development and size. The sexes experience growth spurts at different ages.

NOTE For useful references on anthropometric data, see Bibliography.

The following are examples where body size and weight distribution, as compared to adults, are factors in harm.

a) In the case of thermal injuries, a given area of contact is typically a larger proportion of a child's surface area than is the case for an adult. In addition, children's overall larger surface-area-to-body mass ratio can result in a greater proportion of body fluids being lost from the burnt area.

b) Young children have a large head compared with their body size. Their high centre of mass increases the likelihood of falls, e.g. from furniture or structures on which children might be sitting, climbing or standing. Children often fall directly onto their head.

c) Another effect of the high centre of mass is that it also increases the likelihood of falling into pools, buckets, toilets, bathtubs, etc., into which children are bending or reaching, thereby increasing the risk of drowning.

d) The relatively large head size means that it requires a much larger space to pass through than the rest of the body. Entrapment can occur when the body passes, feet first, through a gap through which the head cannot.

e) The relatively large mass of the head increases the likelihood and severity of whiplash.

f) Children might be able to insert their fingers, hands or other parts of their body into small openings and gaps to access rotating and moving parts or electrical and other hazards.

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g) Small quantities of substances that would not harm an adult can harm a child. They might be more strongly affected than adults by exposure to chemical and radiation hazards due to their large surface to mass ratio as well as their small body size.

5.1.3 Motor development

Motor development refers to the maturation process of gross and fine movements and coordination. Understanding the development of children's motor skills is essential to the design of products to eliminate or mitigate harm.

The development process includes changes from primary involuntary reflex actions to deliberate, goal-directed actions. Milestone achievements in the process include acquiring the strength and skill to support the head, crouch, sit up, roll over, crawl, stand, climb, rock, walk and run, and the ability to manipulate objects with hands and fingers. Until balance, control and strength have sufficiently developed, children are particularly at risk of falling and getting into unsafe positions from which they cannot escape.

EXAMPLE 1 When lying down, babies can move to the edge of a surface and roll off, but be unable to lift themselves up. As a result, they can become wedged between products and suffer positional or compression asphyxia.

EXAMPLE 2 Standing babies and toddlers can become entangled in cords, ribbons, or window dressings within their reach. When they sit or slump, the cords can tighten around their neck, resulting in strangulation.

EXAMPLE 3 Climbing children can get clothing, accessories, and anything they wear (e.g. backpack, hair accessory) caught in furniture items or protrusions. If they cannot extricate themselves, they can hang.

EXAMPLE 4 Children can fall from heights because they lose their balance or grip.

EXAMPLE 5 From about age three months, infants placed to sleep on their backs can turn over and suffocate if the mattress or bedding is too soft.

5.1.4 Physiological development

In addition to their body size and motor functions, there are many other physiological functions that are developing in children. These include sensory functions, biomechanical properties, reaction time, metabolism and organ development.

Sensory development of children occurs over time. Visual development is slower than development of other senses. Even at the stage when most children have vision similar to that of adults, they might have narrower vision or have difficulty with depth perception. As a result, children will have difficulty recognizing hazardous situations.

The following are examples where incomplete physiological development can be a factor in injuries:

a) children's small body size and faster breathing rates result in their being particularly susceptible to potentially toxic substances such as medications, chemicals and plants;

b) children's biochemistry makes them susceptible to toxicity of chemicals, medications and plants not toxic to adults;

c) the characteristics of children's skin, including its thinness, make it more vulnerable to thermal injury;

d) children's bones are not fully developed, resulting in different responses to mechanical forces;

e) children are more susceptible to harm from intense light sources;

f) children are more sensitive to sound pressure.

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