SLOVENSKI STANDARD
oSIST prEN ISO 14091:2020

01-februar-2020

Prilagoditev podnebnim spremembam - Smernice za oceno ranljivosti, vpliva in tveganja (ISO/DIS 14091:2019)

Adaptation to climate change - Guidelines on vulnerability, impacts and risk assessment (ISO/DIS 14091:2019)

Anpassung an den Klimawandel - Vulnerabilität, Auswirkungen und Risikobewertung (ISO/DIS 14091:2019)

Ta slovenski standard je istoveten z: **prEN ISO 14091**

ICS:

13.020.30	Ocenjevanje vpliva na okolje	Environmental impact assessment
13.020.40	Onesnaževanje, nadzor nad onesnaževanjem in ohranjanje	Pollution, pollution control and conservation

oSIST prEN ISO 14091:2020 **en,fr,de**

DRAFT INTERNATIONAL STANDARD

ISO/DIS 14091

ISO/TC **207**/SC **7**

Secretariat: **SAC**

Voting begins on:
2019-11-25

Voting terminates on:
2020-02-17

Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment

ICS: 13.020.30; 13.020.40

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 14091:2019(E)

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Published in Switzerland

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 207, E*nvironmental management*, Subcommittee SC 7, *Greenhouse gas management and related activities*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Climate change is impacting organizations in various ways and will continue to do so for decades to come. Organizations have a growing need to understand, mitigate and manage climate change risks. Climate change risk assessment is key in this context. For responses to be delivered at the necessary pace and scale, it is important that risk assessment approaches are systematic and replicable, permitting learning within and between assessments as new knowledge, technology and experience arise. This document provides guidelines on approaches to assess climate change-related risks.

Risk assessments improve planning of adaptation to climate change and inform the implementation and monitoring of climate change adaptation activities. Adaptation is usually more effective when initiated at an early stage of project development, and when undertaken as a planned process, rather than in response to experiencing impacts. Better knowledge of climate change risks will make it easier and cheaper to respond.

Climate change risks differ from other risks. Often little can be said about their short- or long-term probability so a conventional risk assessment which uses statistical probabilities can be ineffective. For this reason, various approaches have been developed for assessing climate change risks and this document is a guide to the use of screening level assessments and impact chains. The screening level approach can serve as a stand-alone, simplified risk assessment for a straight forward system at risk or those with a limited budget, or serve as a pre-assessment prior to the use of impact chains. Based on a participatory and inclusive process, impact chains approaches provide an opportunity to address all relevant factors. Both screening level assessments and impact chain assessments allow qualitative and quantitative analysis.

This document is relevant to any organization regardless of size, type and nature. For example, it can help financial institutions with decisions in project financing, companies operating in climate-sensitive business sectors, or local governments developing adaptation strategies.

This document covers risks that result from a changing climate. It does not address risks from the transition to a low carbon economy. This document recognises that climate risks can be threats (downside risks) or opportunities (upside risks).

This document emphasises good documentation and communication of climate change risks; these are essential for all subsequent activities. Risk assessments provide information on identifying adaptation actions and prioritising them. Risk assessments following this document also strengthen planning activities on disaster risk reduction (DRR).

This document can be applied by organizations which want to carry out risk assessments (in the newer sense of the 5th Assessment Report (AR 5) of the Intergovernmental Panel on Climate Change (IPCC)) as well as by organizations which want to carry out vulnerability assessments (in the classical sense of IPCC AR4). However, it uses risk assessment as the central term.

This document belongs to an emerging family of standards on adaptation to climate change under the umbrella of ISO 14090 “Adaptation to climate change — Principles, requirements and guidelines”. ISO 14090 describes the following elements of climate change adaptation:

— pre-planning;

— assessing impacts including opportunities;

— adaptation planning;

— implementation;

— monitoring and evaluation; and

— reporting and communication.

This document is part of the second list item above on ‘assessing impacts including opportunities’. ISO/AWI TS 14092 helps define adaptation planning for organizations, local governments and communities. Other ISO standards also deal with climate change or are in some way linked to ISO 14091. For example, ISO 31000 is an excellent companion because it can help organizations manage the risks that are identified and assessed in ISO 14091, which itself is a specialized expansion of the limited risk assessment portion of ISO 31000. ISO 14001 allows for integration of climate change adaptation in an environmental management system; ISO 14091 provides additional information to support this.

ISO 14091 is a guidance document for people working in the field of climate change. It is not meant to serve for certification.

The document is structured starting with an introduction to the concept of climate change risk assessment, followed by the preparation, the implementation and the documentation and communication of the climate change risk assessment.

The guidelines provided in this document are accompanied by a Bibliography and 10 Annexes with supporting examples and information.

In this document, the following verbal forms are used:

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates possibility or capability.

Adaptation to Climate Change — Guidelines on vulnerability, impacts and risk assessment

1 Scope

This document provides guidance for assessing the risks related to the potential impacts of climate change. It describes how to understand vulnerability and how to develop and implement a sound risk assessment in the context of climate change. It can be used for assessing both present and future climate change risks.

Risk assessment according to this document provides a basis for climate change adaptation planning, implementation, and monitoring and evaluation for any organization, regardless of size, type and nature.

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 http://www.iso.org/obp

3.1
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO 14001:2015, 3.1.4]

3.2
interested party
person or *organization* that can affect, be affected by, or perceive itself to be affected by a decision or activity

EXAMPLE Customers, communities, suppliers, regulators, non-governmental organizations, investors, employees and academia.

Note 1 to entry: To “perceive itself to be affected” means the perception has been made known to the organization.

[SOURCE: ISO 14001:2015, 3.1.6, modified EXAMPLE]

3.3
climate
statistical description of weather in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years

Note 1 to entry: The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization.

Note 2 to entry: The relevant quantities are most often near-surface variables such as temperature, precipitation, and wind.

[SOURCE: ISO 14090:2019, 3.4]

3.4
climate change
change in climate that persists for an extended period, typically decades or longer

Note 1 to entry: Climate change can be identified by such means as statistical tests (e.g. on changes in the mean, variability).

Note 2 to entry: Climate change might be due to natural processes, internal to the climate system, or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.

[SOURCE: ISO 14090:2019, 3.5]

3.5
adaptation to climate change
climate change adaptation
process of adjustment to actual or expected climate and its effects

Note 1 to entry: In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities.

Note 2 to entry: In some natural systems, human intervention can facilitate adjustment to expected climate and its effects.

[SOURCE: ISO 14090:2019, 3.1]

3.6
climate projection
simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models

Note 1 to entry: Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.

[SOURCE: Adapted from IPCC, 2014]

3.7
hazard
potential source of harm

Note 1 to entry: The potential for harm can be in terms of loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Note 2 to entry: In this document the term usually refers to climate related physical events or trends or their physical impacts.

Note 3 to entry: Hazard comprises slow-onset developments (e.g. rising temperatures over the long term) as well as rapidly developing climatic extremes (e.g. a heatwave or a landslide) or increased variability.

[SOURCE: ISO/IEC Guide 51:2014, 3.2, modified — Original Note to entry was deleted and a new Notes 1 and 2 to entry have been added to reflect the definition of 'hazard' in IPCC, 2014: Annex II: Glossary. Note 3 to entry has been added.]

3.8
exposure
presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets in places and settings that could be affected

Note 1 to entry: Exposure can change over time, for example as a result of land use change.

[SOURCE: ISO 14090:2019, 3.6]

3.9
sensitivity
degree to which a system or species is affected, either adversely or beneficially, by climate variability or change

Note 1 to entry: The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea level rise).

[SOURCE: Adapted from IPCC, 2014]

3.10
adaptive capacity
ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences

[SOURCE: ISO 14090:2019, 3.2]

3.11
vulnerability
propensity or predisposition to be adversely affected

Note 1 to entry: Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

[SOURCE: ISO 14090:2019, 3.15]

3.12
risk
effect of uncertainty

Note 1 to entry: An effect is a deviation from the expected. It can be positive, negative or both. An effect can arise as a result of a response, or failure to respond, to an opportunity or to a threat related to objectives.

Note 2 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

[SOURCE: ISO 14001:2015, 3.2.10, modified — Note 1 to entry has been modified. Notes 3 and 4 to entry have been deleted.]

3.13
impact
effect on natural and human systems

Note 1 to entry: In the context of climate change the term 'impact' is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate change or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts and sea level rise, are a subset of impacts called physical impacts.

[SOURCE: ISO 14090:2019, 3.8]

3.14
indicator
quantitative, qualitative or binary variable that can be measured or described, in response to a defined criterion

[SOURCE: ISO 13065:2015, 3.27]

4 Introduction to climate change risk assessment

4.1 Concept of climate change risk

Climate change risk describes the impact of climate change on societies, economies and the environment. The concept applies to the present and future potential impacts and risks.

NOTE 1 This document focuses on the risks induced by the consequences of climate change and not risks from climate mitigation policies e.g. transitional risks.

The main components for a risk assessment are (illustrated in Figure A.1 in Annex A):

a) the hazard;

b) the exposure of a given system to the hazard;

c) the sensitivity of the system to the hazard;

d) the (potential) climate change impact – risk without adaptation; and

e) the risk with adaptation (in the future).

Future potential climate change impacts can be modified by the system's adaptive capacity.

EXAMPLE A system can be a region, a community, a household, a supply chain, an economic sector, a business, a population group, an ecosystem, infrastructure and its components.

Climate change impacts occur because a system is exposed to hazards (e.g. drought, flooding, heat stress). The sensitivity of the system (e.g. types of crops, land-use, age of the population) will determine the extent to which these hazards affect it. Impact is a function of both the exposure and the sensitivity of the system to hazards. The system's adaptive capacity influences the degree to which the potential impact becomes a tangible risk. The vulnerability of the exposed system can be expressed as a combination of an organization's sensitivity and its lack of adaptive capacity.

NOTE 2 Though hazards are defined as sources of potential harm (e.g. heatwaves causing agricultural losses) they can sometimes lead to opportunities (e.g. higher temperatures leading to additional tourism opportunities).

NOTE 3 For further information on the concept of climate change risk, see Annex A. A case study appears in Annex B.

4.2 Assessing climate change risk

4.2.1 Objectives

Risk assessments fulfil diverse objectives depending on the information needs of organizations, and on the challenges caused by climate change:

— *Raising Awareness:* Risk assessments help increase awareness of the consequences of climate change.

— *Identification and prioritisation of risks:* Many factors contribute to a system's sensitivity, exposure and adaptive capacity. Climate change risk assessments provide insight into these factors and this helps organizations to prioritise the risks to be addressed.

— *Identification of entry points for climate change adaptation intervention*: The final results and the process, of risk assessment can help identify possible adaptation responses. Risk assessments can show where early action is required; e.g. to avoid locking-in future impacts, and to highlight adaptive capacity development needs.

— *Tracking changes in risk, and monitoring and evaluation of adaptation*: Repeating risk assessments can help to track changes over time and generate knowledge on the effectiveness of adaptation [1].

4.2.2 Value-based judgements

Value-based judgements are necessary in climate change risk assessments. If impacts cannot be measured in the same units (e.g. monetary losses, reduced life expectancy in years), the selection of the most relevant climate change impacts is connected with value-based judgements. Another instance of a value-based judgement is the establishment of critical thresholds if these cannot or can only partially be inferred from empirical evidence. For example, a threshold for critical low precipitation (say 200 mm/year) for agriculture in a given region can be set based on past experiences and agroscientific know-how, but it also depends on judgements as to what is considered "critical". To facilitate the interpretation and evaluation of the results of the risk assessment, it is important to be transparent about where value-based judgements have been applied [2].

5 Preparing a climate change risk assessment

5.1 Establishing the context

Each risk assessment has a unique context which determines its scope, objectives and planned outputs(such as a report). Organizations should define the context of the assessment by considering:

— *The system at risk:* Provide a broad outline of the system at risk.

— *Hazards*: Identify which hazards can potentially affect the system at risk, choose which ones to include in the risk assessment, and specify the type of information required.

— *Processes*: Identify existing or planned processes and activities related to the risk assessment.

— *Knowledge*: Identify available knowledge of climate change and variability, of impacts and existing risk, of existing impact assessments (e.g. including research results and local knowledge) and knowledge of the adaptive capacity of the organization. Keep in mind that the spectrum of possible impacts is very broad (see ISO 14090 [3]).

— *Interested parties*: Identify and involve interested parties in the process as far as it is practicable (e.g. aspects referring to risks raised by interested parties, such as environmental associations, can provide relevant inputs to facilitate broader acceptance of the risk assessment).

— *Resources*: Establish the availability of financial, human and technical resources and information/data.

— *External developments*: Identify external factors that could influence the system at risk (e.g. demographic changes, land use changes, technological developments, changes in the political and institutional context, market changes, and global developments) [1].

— *Regulatory obligations, responsibilities to others:* Identify regulatory or other obligations that can influence the objectives, the process or the outcome of the risk assessment.

NOTE Additional guidance on preparing and conducting a risk assessment can be found in ISO 31000 [4]. It places this document in the broader context of risk management.

5.2 Identifying objectives and expected outcomes

An organization's decision to conduct a risk assessment is driven by a need or an information gap.

The organization should:

— *Determine* the objective and expected outcomes of the risk assessment and the processes that the risk assessment will support or feed into.

— *Identify* the information gaps that the risk assessment is to address.

— *Define* how the knowledge and results that will be generated are to be used (e.g. input into on-going adaptation efforts or planning new adaptation actions).

— *Clarify* how the results of the risk assessment will be depicted (e.g. map with risk hotspots, ranking of vulnerable sectors, narrative analysis of risk and its relevant factors, etc.).