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

Adaptation au changement climatique — Lignes directrices sur la vulnérabilité, les impacts et l'évaluation des risques

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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).

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

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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/SS S26, *Environmental management*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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.

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Introduction

Climate change is impacting organizations in various ways and it is anticipated that these impacts will continue well into the future. Organizations have an increasing 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 experienced impacts. Better knowledge of climate change risks will make it easier and less costly to respond.

Climate change risks differ from other risks. It is often difficult or even impossible to quantify their short- or long-term probability so a conventional risk assessment that uses statistical probabilities can be ineffective. For this reason, various approaches have been developed for assessing climate change risks. This document provides guidance on the use of screening assessments and impact chains. The screening approach can serve as a stand-alone, simplified risk assessment for a straight-forward system at risk or for organizations 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 chain approaches are more comprehensive, providing an opportunity to address all relevant factors. Both screening assessments and impact chain assessments allow for 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 that result from the transition to a low carbon economy. This document recognizes that climate risks can be threats or opportunities.

This document emphasizes comprehensive documentation and communication of climate change risks; these are essential for all subsequent activities. Risk assessments, among other purposes, provide information on identifying adaptation actions and prioritizing them. Risk assessments conducted in accordance with this document also strengthen planning activities on disaster risk reduction (DRR).

This document can be applied by organizations that want to carry out climate change risk assessments [in the sense of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC)] as well as by organizations that want to carry out vulnerability assessments (in the sense of the 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, which describes the following elements of climate change adaptation:

— pre-planning;

— assessing impacts including opportunities;

— adaptation planning;

— implementation;

— monitoring and evaluation;

— reporting and communication.

This document is part of the second item on the above list: “assessing impacts including opportunities”. ISO/TS 14092:2020 helps define adaptation planning for local governments and communities. Other

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International Standards also deal with climate change or are in some way linked to this document. For example, ISO 31000 is an excellent companion because it can help organizations manage the risks that are identified and assessed in this document, which itself is a specialized expansion of the limited risk assessment portion of ISO 31000. ISO 14001 allows for the integration of climate change adaptation into an environmental management system and this document provides additional information to support this.

This document is a guidance document for people working in the field of climate change.

This 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 supporting examples and information.

In this document, the following verbal forms are used:

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates a possibility or capability.

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

1 Scope

This document gives guidelines 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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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* (3.1) 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 applying this document.

[SOURCE: ISO 14001:2015, 3.1.6, modified — "academia" has been added to the example and "applying this document" has been added to Note 1 to entry.]

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3.3
system
set of interrelated or interacting elements

[SOURCE: ISO 9000:2015, 3.5.1]

3.4
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[26].

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]

3.5
climate change
change in *climate* (3.4) 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* (3.3), 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]

3.6
adaptation to climate change
climate change adaptation
process of adjustment to actual or expected *climate* (3.4) and its effects

Note 1 to entry: In human *systems* (3.3), 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]

3.7
climate projection
simulated response of the climate *system* (3.3) 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]

3.8
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* (3.14), as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

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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 increased variability.

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

3.9
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]

3.10
sensitivity
degree to which a *system* (3.3) or species is affected, either adversely or beneficially, by *climate* (3.4) 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]

3.11
adaptive capacity
ability of *systems* (3.3), 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]

3.12
vulnerability
propensity or predisposition to be adversely affected

Note 1 to entry: Vulnerability encompasses a variety of concepts and elements including *sensitivity* (3.10) or susceptibility to harm and lack of capacity to cope and adapt.

[SOURCE: ISO 14090:2019, 3.15]

3.13
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.]

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3.14
impact
effect on natural and human *systems* (3.3)

Note 1 to entry: In the context of *climate change* (3.5), 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* (3.12) 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]

3.15
impact chain
analytical approach that enables understanding of how given *hazards* (3.8) generate direct and indirect *impacts* (3.14) which propagate through a *system* (3.3) at *risk* (3.13)

3.16
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 potential impact of climate change on societies, economies and the environment.

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

NOTE 2 The impacts of climate change can arise from gradual changes in climate conditions as well as an increase in extreme weather events.

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

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, i.e. risk without adaptation;

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

Future potential climate change impacts can be modified by the adaptive capacity of a system.

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

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