



International
Standard

ISO 12749-3

**Nuclear energy, nuclear
technologies, and radiological
protection — Vocabulary —**

**Part 3:
Nuclear installations, processes and
technologies**

*Énergie nucléaire, technologies nucléaires et protection
radiologique — Vocabulaire —*

Partie 3: Installations nucléaires, procédés et technologies

**Second edition
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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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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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 85, *Nuclear energy, nuclear technologies, and radiological protection*.

This second edition cancels and replaces the first edition (ISO 12749-3:2015), which has been technically revised.

The main changes are as follows:

- addition of new concepts;
- modification of definitions;
- change of sources.

A list of all parts in the ISO 12749 series can be found on the ISO website.

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

This document will provide terms and definitions for concepts associated with nuclear installations, processes, and technologies. These include specific subjects such as the nuclear fuel cycle; ex-reactor nuclear criticality safety, analytical methodologies, transport of radioactive materials, characterization of materials, radioactive waste management, and decommissioning of nuclear installations. Excluded topics are specific enabling technologies and techniques for non-peaceful applications, sealed sources, radiation processing, nuclear power plants and research reactors (with regard to nuclear criticality safety while fuel is loaded in the reactor core). Terminological data are taken from ISO standards developed by ISO/TC 85/SC 5 and other technically validated documents issued by the International Atomic Energy Agency (IAEA) or other international organizations.

Unambiguous communication of concepts associated with nuclear installations, processes, and technologies is crucial to prevent misunderstandings or misinterpretations of terms used in documents developed by ISO/TC 85/SC 5. In line with the international demand for harmonization of terminology regarding nuclear and radiological activities, this document will contribute by providing terms and definitions to meet the requirements of users and industry. It will also improve promotion, knowledge and use of international standards dealing with nuclear installations, processes and technologies and will help experts developing technical standards to avoid overlapping and contradiction.

Nuclear fuels for different power reactors are produced according to different designs. However, several concepts are present in all of them and need to be designated by common terms and described by harmonized definitions in order to avoid misunderstandings. Difficulties can also arise due to the wide variety of units of measure employed. Thus, to enhance comprehension as well as comparability, it is advisable to adopt unified units of measure.

Arrangement of terms and definitions is based on concepts systems that show corresponding relationships among the various concepts. Such arrangement provides users with a structured view of the nuclear installations, processes, and technologies sector and will facilitate common understanding of all related concepts. In addition, concepts systems and conceptual arrangement of terminological data will be helpful to any kind of user because it will promote clear, accurate, and useful communication.

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Nuclear energy, nuclear technologies, and radiological protection — Vocabulary —

Part 3: Nuclear installations, processes and technologies

1 Scope

This document deals with the terminological data used in the standards regarding the standardization and promotion of good practices associated with the planning, design, construction, operation and decommissioning of installations, processes and technologies involving radioactive materials.

The vocabulary of nuclear installations, processes and technologies includes fuel cycle, ex-reactor nuclear criticality safety, analytical methodologies, transport of radioactive materials, materials characterization, radioactive waste management and decommissioning.

NOTE See [Annex A](#) for the methodology used to develop the vocabulary.

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 terminology databases for use in standardization at the following addresses:

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

3.1 Terms related to nuclear materials

3.1.1

nuclear material

material containing one or more of the following: plutonium except that with isotopic concentration exceeding 80 % in ^{238}Pu ; uranium enriched in the isotope 235 or 233; uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore residue

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7.]

3.1.2

critical

having an effective neutron multiplication factor equal to unity

[SOURCE: ISO 1709:2018, 3.1]

3.1.3

nuclear criticality

state of a nuclear chain reacting medium when the *nuclear chain reaction* (3.1.9) is just self-sustaining (or *critical* (3.1.2)), i.e. when the reactivity is zero

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.1.4

radionuclide

nuclide which is in an unstable state due to excess of internal energy and which will attain a stable state by emitting radiation

Note 1 to entry: *Radionuclides* (3.1.4) are either naturally occurring, such as ^{40}K , ^{235}U , ^{238}U , ^{232}Th and their radioactive decay products, or produced by activation or other artificial means.

[SOURCE: ISO 12749-1:2020, 3.1.8]

3.1.5

radioactivity

stochastic process whereby nuclei undergo spontaneous disintegration, usually accompanied by the emission of subatomic particles, or photons

[SOURCE: ISO 12749-1:2020, 3.1.1]

3.1.6

nuclear installation

any nuclear facility subject to authorization that is part of the *nuclear fuel cycle* (3.3.1), except facilities for the mining or processing of uranium ores or thorium ores and disposal facilities for *radioactive waste* (3.6.1)

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.1.7

fissionable nuclide

<neutrons> nuclide capable of undergoing fission by interaction with neutrons of some energy

[SOURCE: LA-11627-MS, Glossary of Nuclear Criticality Terms. Los Alamos National Laboratory, 1989]

Note 1 to entry: Fissionable nuclides include ^{238}U , ^{240}Pu , and others with neutron-energy fission thresholds, in addition to those nuclides that are fissile.

3.1.8

fissile nuclide

nuclide capable of undergoing fission by interaction with neutrons of any energy

[SOURCE: ISO 1709:2018, 3.4]

Note 1 to entry: The term is usually applied to fission predominantly with slow neutrons. The interpretation of “slow” may vary but the properties of fissile nuclides are clearly distinct from other *fissionable nuclides* (3.1.7).

Note 2 to entry: Particular examples are ^{233}U , ^{235}U , ^{239}Pu and ^{241}Pu .

3.1.9

nuclear chain reaction

series of nuclear reactions in which one of the agents necessary to the series is itself produced by the same reactions

[SOURCE: ISO 1709:2018, 3.8]

3.1.10

fission product

radionuclide ([3.1.4](#)) produced by nuclear fission

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.1.11

burnup

loss of fissile material by the fission process that is usually described in terms of the number of fissioned atoms or on the total energy liberated in unit volume or mass

Note 1 to entry: Burnup *fission product* ([3.1.10](#)) as energy released by fissions is commonly used for NPP

Note 2 to entry: Burnup as number of fissions per unit volume or mass is commonly used for fuel behaviour modelling and neutronic calculations

Note 3 to entry: Burnup as number of fissions is commonly used for experimental reactors

3.1.12

subcriticality

having or involving a chain reaction that is not self-sustaining

3.1.13

subcriticality limit

limit value of *subcriticality dimension* ([3.1.14](#)) which is respected in order to ensure *subcriticality* ([3.1.12](#)) of a unit

[SOURCE: ISO 21391:2019, 3.8]

3.1.14

subcriticality dimension

controlled geometrical dimension (item dimension or layout dimension) for which a limit shall be respected to ensure *subcriticality* ([3.1.12](#)) of a unit

[SOURCE: ISO 21391:2019, 3.7, modified — The word "controlled" was moved at the beginning of the definition.]

3.1.15

neutron leakage

neutrons leaving a fissile system boundary such that they no longer interact with that system

Note 1 to entry: For an array of fissile units, neutron leakage from one unit may or may not interact with other units.

[SOURCE: ISO 1709:2018, 3.7]

3.1.16

neutron absorber

material with which neutrons interact significantly by reactions resulting in their disappearance as free particles

[SOURCE: ISO 1709:2018, 3.6]

3.1.17

over batching

unintended increase in the quantity of a material that is controlled for *nuclear criticality safety* ([3.4.1](#)) such that one or more extra discrete quantities are present

[SOURCE: ISO 1709:2018, 3.13]

3.1.18

permeation

passage of a fluid through a solid permeable barrier (even if there are no *leaks* (3.5.17)) by adsorption-diffusion-desorption mechanisms

Note 1 to entry: Permeation should not be considered as a release of activity unless the fluid itself is radioactive. In this document, permeation is applied only to gases.

[SOURCE: ISO 12807:2018, 3.14]

3.1.19

permeation rate

quantity of gases passing through permeable walls per unit time

[SOURCE: ISO 12807:2018, 3.15]

3.1.20

attenuation

physical process based on interaction between a radiation source and matter placed in the path of the radiation that results in a decrease in the intensity of the emitted radiation

Note 1 to entry: Attenuation experienced in non-destructive analysis (NDA) of *waste packages* (3.6.12) includes self-attenuation by the radioactive material itself as well as attenuation effects in the *waste matrix* (3.6.14), internal barrier(s) and external container(s).

[SOURCE: ISO 19017:2015, 2.2]

3.1.21

attenuation correction factor

used to correct (compensate) for the effect of *attenuation* (3.1.20) within an NDA measurement equal to the ratio between the unattenuated and the attenuated radiation flux

Note 1 to entry: After attenuation correction the measured quantity is considered to be representative of the unattenuated activity of the radioactive substance measured.

[SOURCE: ISO 19017:2015, 2.3]

Note 2 to entry: A subcritical dimension is a different term, usually referring to a fissile material dimension that relies on single-parameter control to avoid making a unit critical. Examples are *subcritical cylinder* (3.5.6) diameter, subcritical slab thickness and subcritical volume.

Note 3 to entry: The *subcriticality* (3.1.12) of a unit may be ensured by other types of controls in addition to dimensional controls (e.g. mass control, density control).

3.2 Terms related to nuclear fuels

3.2.1

nuclear fuel

fissionable *nuclear material* (3.1.1) in the form of fabricated elements for loading into the reactor core of a civil nuclear power plant or research reactor

[SOURCE: ISO 12749-1:2020, 3.2.5]

3.2.2

cladding

external layer of material that houses *nuclear fuel* (3.2.1) and provides the containment (means of confinement) of *radionuclides* (3.1.4) produced during fission

Note 1 to entry: Material also provides structural support and protection from chemically reactive conditions (e.g., corrosion).

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p.]

ISBN: 978-92-0-141822-7, modified — Change “tube of pellets” with “external layer of” and delete “tube of” and “material” and add Note 1 to entry.]

3.2.3

nuclear fuel pellet

nuclear fuel (3.2.1) in ceramic form and with a cylindrical shape

3.2.4

fuel element

nuclear fuel (3.2.1), its *cladding* (3.2.2) and any associated components necessary to form a structural entity

Note 1 to entry: Commonly referred to as “fuel rod” in light water reactors.

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation protection and EMERGENCY Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7 modified — Delete the term “rod”.]

Note 2 to entry: In some countries “fuel element” is used as a synonym for “*fuel assembly*” (3.2.5).

3.2.5

fuel assembly

set of *fuel elements* (3.2.4) and associated components which are loaded into and subsequently removed from a reactor core as a single unit

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7.]

Note 1 to entry: In light water reactors “fuel elements” in the definition should be replaced with “fuel rods”.

Note 2 to entry: In some countries “fuel element” is used as a synonym for “fuel assembly”.

Note 3 to entry: In some countries “fuel bundle” is used as a synonym for “fuel assembly”.

3.2.6

sinter

increase the bonding in a mass of powder or a compact by heating below the melting point of the main constituent

[SOURCE: ASTM B243-22]

3.2.7

specific surface

surface area of one gram of powder, usually expressed in square centimetres

[SOURCE: ASTM B243-22]

3.2.8

theoretical density

density of a material calculated from the number of atoms per unit cell and from the measurement of the lattice parameters

3.2.9

apparent density

loose bulk density

dry mass per unit volume of a powder obtained by free pouring under specified conditions

[SOURCE: ISO 9161:2019, 3.1]

3.2.10

tap density

dry mass per unit volume of a powder in a container that has been tapped under specified conditions

[SOURCE: ISO 9161:2019, 3.2]

3.2.11

normal stress

component of stress normal to the plane of reference

[SOURCE: ISO 10276:2019, 3.1.10]

3.2.12

bending stress

variable component of *normal stress* ([3.2.11](#)), which might not be linear across the thickness

[SOURCE: ISO 10276:2019, 3.1.1]

3.2.13

membrane stress

component of *normal stress* ([3.2.11](#)) that is uniformly distributed and equal to the average stress across the thickness of the section under consideration

[SOURCE: ISO 10276:2019, 3.1.9]

3.2.14

linearized stress

sum of the *membrane stress* ([3.2.13](#)) and of the linear component of the *bending stress* ([3.2.12](#))

[SOURCE: ISO 10276:2019, 3.1.5]

3.2.15

peak stress

maximum stress that occurs in a component by reason of geometry, local discontinuities or local thermal stress, including the effects, if any, of stress concentration

[SOURCE: ISO 10276:2019, 3.1.12]

3.2.16

scrap

residue that contains sufficient quantities of *nuclear material* ([3.1.1](#)) to be worthy of recovery

3.3 Terms related to nuclear fuel cycle

3.3.1

nuclear fuel cycle

operations associated with the production of nuclear energy

Note 1 to entry: The nuclear fuel cycle includes the following stages:

- a) mining and processing of uranium or thorium ores;
- b) conversion;
- c) enrichment of uranium;
- d) manufacturing of *nuclear fuel* ([3.2.1](#));
- e) uses of the *nuclear fuel* ([3.2.1](#));
- f) *reprocessing* ([3.3.2](#)) and *recycling* ([3.3.6](#)) of *spent nuclear fuel* ([3.3.9](#));

- g) temporary *radioactive material storage* (3.6.15) of spent nuclear fuel and *radioactive waste* (3.6.1) from fuel fabrication and *reprocessing* (3.3.2) and disposal of *spent nuclear fuel (open fuel cycle)* (3.3.13) or high-level waste (*closed fuel cycle* (3.3.14));
- h) any related research and development activities;
- i) *transport* (3.5.1) of radioactive material;
- j) all waste management activities (including decommissioning relating to operations associated with the production of nuclear energy).

Note 2 to entry: Reactor operation and other activities at a reactor site are not addressed in this part of ISO 12749, but are addressed in ISO 12749-5.

[SOURCE: ISO 12749-1:2020, 3.2.6]

3.3.2

reprocessing

process or operation, the purpose of which is to extract radioactive isotopes from *spent nuclear fuel* (3.3.9) for further use

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.3.3

reprocessing plant

installation for the chemical separation of *nuclear material* (3.1.1) from *fission products* (3.1.10) following dissolution of *spent nuclear fuel* (3.3.9)

3.3.4

solvent extraction

process used to selectively extract actinide elements from aqueous medium

3.3.5

PUREX process

chemical process used to separate plutonium and uranium from *fission products* (3.1.10) and from each other by means of *solvent extraction* (3.3.4) with tributyl phosphate (TBP)

3.3.6

recycling

use, for the fabrication of *nuclear fuel* (3.2.1) of fissionable materials separated from *spent nuclear fuel* (3.3.9)

3.3.7

depleted uranium

uranium containing a lesser mass percentage of ^{235}U than natural uranium

Note 1 to entry: This usage is specific to the Transport Regulations^[11].

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

Note 2 to entry: Bulk of the by-product (~96 %) from uranium enrichment.

3.3.8

used nuclear fuel

nuclear fuel (3.2.1) that has been activated in the fission process of a nuclear reactor core

3.3.9

spent nuclear fuel

nuclear fuel (3.2.1) that has been burned in the core of a nuclear reactor and is no longer efficient to maintain its specific nuclear service

3.3.10

uranium concentrate

uranium ore concentrate

product with a high concentration in uranium obtained by physical and chemical treatments of the ores, requiring further refinement before it is suitable for nuclear use

EXAMPLE Yellowcake, concentrated crude oxide U_3O_8 .

3.3.11

remediation

measures taken for contaminant removal, containment or monitored non-intervention at a contaminated site to reduce exposure to radiation, and for improvement in the environmental and/or economic value of the contaminated site

Note 1 to entry: Remediation of a site does not necessarily imply a restoration of the site to pristine condition.

[SOURCE: ISO 18557:2017, 3.22]

3.3.12

remediation objectives

objectives, including those related to technical, administrative and legal requirements

EXAMPLE Technical objectives: residual contamination concentrations, engineering performance.

[SOURCE: ISO 18557:2017, 3.23]

Note 1 to entry: *Remediation* ([3.3.11](#)) of a site does not necessarily imply a restoration of the site to pristine condition.

[SOURCE: ISO 18557:2017, 3.22]

3.3.13

open fuel cycle

mining, processing, conversion, enrichment of uranium, *nuclear fuel* ([3.2.1](#)) fabrication, reactor operation, electrical generation or other energy products, storage of *spent nuclear fuel* ([3.3.9](#)), disposal and final end states for all waste

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.3.14

closed fuel cycle

mining, processing, conversion, enrichment of uranium, *nuclear fuel* ([3.2.1](#)) fabrication, reactor operation, electrical generation or other energy products, *reprocessing* ([3.3.2](#)) to recover fissile material, storage of reprocessed fissile material, disposal (for highly radioactive *fission products* ([3.1.10](#))) and final end states for all waste

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.4 Terms related to nuclear criticality safety

3.4.1

nuclear criticality safety

protection against the consequences of a *nuclear criticality accident* ([3.4.5](#)), preferably by prevention of the accident and responses to such accidents should they occur

[SOURCE: ISO 1709:2018, 3.10]

3.4.2

nuclear criticality safety programme

arrangements and procedures implemented in order to ensure *nuclear criticality safety* (3.4.1) for a site, facility or process

[SOURCE: ISO 23133:2021, 3.8]

3.4.3

nuclear criticality safety strategy for waste

high level plan as to how the *nuclear criticality safety* (3.4.1) of the waste will be managed throughout the waste life cycle

[SOURCE: ISO 22946:2020, 3.2]

3.4.4

nuclear criticality safety evaluation

technically reviewed analysis that establishes the technical bases, limits, and controls for the *nuclear criticality safety* (3.4.1) of a given operation

[SOURCE: ISO 1709:2018, 3.11]

3.4.5

nuclear criticality accident

release of energy as a result of inadvertently producing a self-sustaining or divergent *nuclear chain reaction* (3.1.9)

[SOURCE: ISO 1709:2018, 3.9]

3.4.6

operations staff

<nuclear criticality safety> workers who, in the act of carrying out activities as part of a facility or process, have duties for maintaining *nuclear criticality safety* (3.4.1)

Note 1 to entry: These include staff and (sub) contractors performing activities in accordance with written procedures as part of production, processing and handling of fissile material. They may also include workers such as maintenance workers, and health physics monitors if their actions or inaction could have an effect on *nuclear criticality safety* (3.4.1). They do not include support staff, whose actions would not be expected to affect fissile material processes.

[SOURCE: ISO 23133:2021, 3.1, modified — Replace “they could have an effect on” with “if their actions or inaction have an effect on” in the second sentence of the Note 1 to entry.]

3.4.7

operations supervisor

<nuclear criticality safety> individual who directs or supervises *operations staff* (3.4.6) in the production, processing or handling of fissile material, and who accept responsibility for the safety of operations under his/her control

[SOURCE: ISO 23133:2021, 3.2]

3.5 Terms related to transport of radioactive material

3.5.1

transport

<radioactive material> deliberate physical movement of radioactive material from one place to another

Note 1 to entry: The concept of transport does not include the movement forming part of the means of propulsion.

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.5.2

package

packaging (3.5.7) together with its radioactive contents as presented for *transport* (3.5.1)

[SOURCE: ISO 12807:2018, 3.12]

3.5.3

transport cycle

complete round-trip journey of a *package* (3.5.2) between two successive loadings

[SOURCE: ISO 10276:2019, 3.1.21]

3.5.4

tie-down

securing of the *package* (3.5.2) to the conveyance

[SOURCE: ISO 10276:2019, 3.1.18]

3.5.5

load case

specific configuration of *transport* (3.5.1) or lifting associated to a *total mass* (3.5.22), (3.5.23) specified value and direction of acceleration, a given number of acting trunnions, and a given point/area of application of the load on the *trunnion* (3.5.8)

[SOURCE: ISO 10276:2019, 3.1.6]

3.5.6

cylinder

<transport>*pressure vessel* (3.5.21), equipped with its valves and plugs, as applicable

[SOURCE: ISO 7195:2020, 3.6]

3.5.7

packaging

assembly of components necessary to enclose the radioactive contents completely

[SOURCE: ISO 12807:2018, 3.13]

3.5.8

trunnion

projection, typically cylindrical in shape, attached on a *packaging* (3.5.7) by various means and used for lifting, tilting and/or *tie-down* (3.5.4) of the *package* (3.5.2)

Note 1 to entry: Parts permanently attached to the trunnion are considered as being part of the trunnion.

[SOURCE: ISO 10276:2019, 3.1.22, modified — Split the definition and state the last sentence in the Note 1 to entry.]

Note 2 to entry: Trunnion attachment methods are as follows: welding, bolting, interference fitting and bolting, or any combination of these methods.

3.5.9

removable trunnion

trunnion (3.5.8), on a *package* (3.5.2) secured by non-permanent methods, e.g. bolting

[SOURCE: ISO 10276:2019, 3.1.16, modified — Stating the term “bolting” as an example.]

3.5.10

welded trunnion

trunnion (3.5.8), directly secured to the *packaging* (3.5.7) by welding

[SOURCE: ISO 10276:2019, 3.1.26]

3.5.11

trunnion attachment component

component used to secure the *trunnion* (3.5.8) to the *packaging* (3.5.7) body

EXAMPLE Welding to the packaging body, bolts, removable shear discs, female threads or housing in the packaging body, removable baseplates.

[SOURCE: ISO 10276:2019, 3.1.27, modified — State examples separated from the definition into a separate EXAMPLES field.]

3.5.12

trunnion system

assembly of *trunnion* (3.5.8) and *trunnion attachment components* (3.5.11)

[SOURCE: ISO 10276:2019, 3.1.25]

3.5.13

primary trunnion system

trunnion system (3.5.12) provided as a primary means for lifting and/or tilting, *tie-down* (3.5.4) and supporting of the *package* (3.5.2)

[SOURCE: ISO 10276:2019, 3.1.14]

3.5.14

secondary trunnion system

trunnion system (3.5.12) provided as an additional or alternative means for the *tie-down* (3.5.4) supporting or lifting of *packages* (3.5.2)

[SOURCE: ISO 10276:2019, 3.1.17]

3.5.15

containment system

<transport> assembly of components of the *packaging* (3.5.7) intended to retain the radioactive material during *transport* (3.5.1)

[SOURCE: ISO 12807:2018, 3.4]

3.5.16

leaktight

<containment systems> general term indicating that a *containment system* (3.5.15) meets the required level of containment for particular contents

[SOURCE: ISO 12807:2018, 3.9]

3.5.17

leak

<containment systems> any unwanted opening or openings through a *containment system* (3.5.15) that could permit the escape of the contents

[SOURCE: ISO 12807:2018, 3.6]

3.5.18

leakage

<containment systems> transfer of a material from the *containment system* (3.5.15) to the environment through a *leak* (3.5.17) or leaks

[SOURCE: ISO 12807:2018, 3.7]

3.5.19

leakage rate

<containment systems> quantity of solid particles, liquids or gases passing through *leaks* (3.5.17) per unit time

Note 1 to entry: The term leakage rate can refer to the radioactive material (gas, liquid, solid or any mixture of these) or to the test fluid.

Note 2 to entry: The dimensions of the rate of solid *leakage* (3.5.18) are mass divided by time. The dimensions of the rate of liquid leakage can be mass divided by time or volume divided by time. The dimensions of the rate of gas leakage are the product of pressure and volume (this is a mass-like unit) divided by time at a known temperature.

[SOURCE: ISO 12807:2018, 3.8]

3.5.20

gas leakage test methodology

method of specifying a gas *leakage* (3.5.18) test which relates permissible activity release rates of the radioactive contents carried within a *containment system* (3.5.15) to equivalent gas *leakage rates* (3.5.19) under specified test conditions

[SOURCE: ISO 12807:2018, 3.5]

3.5.21

pressure vessel

container designed, fabricated, examined, inspected, tested and certified in accordance with the applicable code

[SOURCE: ISO 7195:2020, 3.18, modified — Add the word “applicable” after code.]

3.5.22

total mass

<lifting> maximum mass of a *package* (3.5.2) as supported by the *trunnion systems* (3.5.12) during lifting, fitted with all necessary ancillaries and equipment, and including the radioactive material (and water as appropriate

[SOURCE: ISO 10276:2019, 3.1.19]

3.5.23

total mass

<transport> maximum mass of a *package* (3.5.2) fitted with all ancillaries (shock absorbers, neutron shields, covers, transport frame as appropriate, etc.), as presented for *transport* (3.5.1) and as supported by the *trunnion systems* (3.5.12)

3.5.24

competent authority

<transport> national or international regulatory body or authority designated or otherwise recognized as such for any purpose in connection with the relevant *transport* (3.5.1) regulations for dangerous goods

[SOURCE: ISO 7195:2020, 3.4]

3.6 Terms related to radioactive waste

3.6.1

radioactive waste

material for which no further use is foreseen that contains, or is contaminated with, *radionuclides* (3.1.4) at activity concentrations greater than clearance levels as established by the regulatory body

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

Note 1 to entry: This also includes:

- a) solids containing or contaminated with *fissile nuclides* (3.1.8) for which no further use is foreseen, but for which further work to prepare the waste for final disposal is programmed, e.g. volume reduction;
- b) residual quantities of liquid or slurry type wastes which are either intimately associated with the solid nuclear wastes, or generated as a result of processing or handling the waste.

[SOURCE: ISO 22946:2020, 3.1]

3.6.2

radioactive waste characterization

determination of the physical, mechanical, chemical, radiological and biological properties of the waste to establish the need for further adjustment, treatment or conditioning, or its suitability for further handling, processing, *radioactive material storage* (3.6.15) or disposal

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7, modified — Add the words “mechanical” and “biological”.]

3.6.3

representative sample

sample taken from a process of the material in that process or that quantity of material which is considered to possess the average characteristics of the material

Note 1 to entry: Samples of waste are used to determine the scaling-factor parameters for the target waste stream. A representative sample is meant to closely resemble the characteristic nuclide content and activity proportions of the target waste stream.

[SOURCE: ISO 12749-1:2020, 3.5.4]

3.6.4

radioactive waste management

all administrative and operational activities involved in the handling, pre-treatment, treatment, conditioning, *transport* (3.5.1), *radioactive material storage* (3.6.15), and disposal of *radioactive waste* (3.6.1)

[SOURCE: ISO 12749-1:2020, 3.5.7]

3.6.5

waste form

waste in its physical and chemical form after treatment and/or conditioning, resulting in a solid product, prior to *packaging* (3.5.7)

[SOURCE: ISO 12749-1:2020, 3.5.6]

3.6.6

waste processing

any operation that changes the characteristics of *radioactive waste* (3.6.1), including pretreatment, treatment and conditioning

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.7

segregation

activity where types of *radioactive waste* (3.6.1) or material (radioactive or exempt) are separated or are kept separate on the basis of radiological, chemical and/or physical properties, to facilitate waste handling and/or processing

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.8

waste treatment

operations intended to benefit safety and/or economy by changing the characteristics of the waste

Note 1 to entry: Three basic treatment objectives are (a) volume reduction; (b) removal of *radionuclides* (3.1.4) from the waste; (c) change of composition.

Note 2 to entry: Treatment can result in an appropriate *waste form* (3.6.5).

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7, modified — Change the definition to ISO formatting, and in Note 2 to entry, change “may” with “can”.]

3.6.9

immobilization

conversion of waste into a *waste form* (3.6.5) by solidification, embedding or encapsulation

Note 1 to entry: Immobilization reduces the potential for migration or dispersion of *radionuclides* (3.1.4) during handling, *transport* (3.5.1), storage, and/or disposal.

[SOURCE: IAEA. IAEA Nuclear safety and security glossary. Terminology used in nuclear safety, nuclear security, radiation protection and emergency preparedness and response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7.]

3.6.10

vitrification

process of incorporating *radioactive waste* (3.6.1) into a glass or glass-like form

Note 1 to entry: Vitrification is commonly applied to the solidification of liquid high level *radioactive waste* (3.6.1) from the *reprocessing* (3.3.2) of *spent nuclear fuel* (3.3.9).

[SOURCE: IAEA. IAEA Radioactive waste management glossary, Vienna: IAEA, 2003 Edition, modified — Split the definition, stating the second sentence in the note 1 to entry, replacing the word “materials” with “radioactive waste” in the definition and add the word “nuclear” to the term “spent fuel” and add the word “radioactive” before “waste”.]

3.6.11

waste conditioning

operations that produce a *radioactive waste* (3.6.1) *package* (3.5.2) suitable for handling, *transport* (3.5.1), *radioactive material storage* (3.6.15) and/or disposal

Note 1 to entry: Conditioning may include the conversion of the *radioactive waste* (3.6.1) to a solid *waste form* (3.6.5), enclosure of the waste in containers and, if necessary, provision of an overpack.

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.12

waste package

product of conditioning that includes the *waste form* (3.6.5) and any container(s) and internal barriers, as prepared for handling, *transport* (3.5.1), storage and/or disposal

Note 1 to entry: The internal barriers may be absorbing materials and liner.

[SOURCE: ISO 12749-1:2020, 3.5.3]

3.6.13

waste container

vessel into which the *waste form* (3.6.5) is placed for handling, *transport* (3.5.1), storage and/or eventual disposal

Note 1 to entry: The waste container is also the outer barrier protecting the waste from external intrusions.

Note 2 to entry: The waste container is a component of the *waste package* (3.6.12).

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.14

waste matrix

part of the waste from inside a *waste package* (3.6.12) in which the radioactive substances are dispersed

[SOURCE: ISO 12749-1:2020, 3.5.2]

3.6.15

radioactive material storage

holding of radioactive sources, radioactive material, *spent nuclear fuel* (3.3.9) or *radioactive waste* (3.6.1) in a facility that provides for their/its containment, with the intention of retrieval

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.16

waste generator

operating organization of a facility or activity that generates *radioactive waste* (3.6.1)

Note 1 to entry: For convenience, the scope of the term waste generator is sometimes extended to include whoever currently has the responsibilities for the waste generator.

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7, modified — Add the word “radioactive” before “waste” in the definition.]

3.6.17

waste disposal

emplacement of waste in an appropriate facility without the intention of retrieval

Note 1 to entry: Some countries use the term disposal to include discharges of effluents to the environment.

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7, modified — Replace “states” with “countries”.]

3.6.18

repository

disposal facility

engineered facility where *radioactive waste* (3.6.1) is emplaced for disposal

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

3.6.19

waste acceptance criteria

quantitative or qualitative criteria specified by the regulatory body, or specified by an operator and approved by the regulatory body, for the *waste form* (3.6.5) and *waste package* (3.6.12) to be accepted by the operator of a waste management facility

Note 1 to entry: Waste acceptance criteria specify the radiological, mechanical, physical, chemical and biological characteristics of *waste packages* (3.6.12) and unpackaged waste.

Note 2 to entry: Waste acceptance criteria might include, for example, restrictions on the activity concentration or total activity of particular *radionuclides* (3.1.4) (or types of radionuclide) in the waste, on their heat output or on the properties of the *waste form* (3.6.5) or of the *waste package* (3.6.12)."

[SOURCE: IAEA. IAEA Nuclear Safety and Security Glossary. Terminology Used in Nuclear SAFETY, nuclear security, RADIATION Protection and Emergency Preparedness and Response. Vienna: IAEA, 2022. 246 p. ISBN: 978-92-0-141822-7]

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Annex A

(informative)

Methodology used in the development of the vocabulary

A.1 General

The specific character of the nuclear fuel cycle concepts contained in this document requires the use of

- clear technical descriptions, and
- a coherent and harmonized vocabulary that is easily understandable by all potential users.

Concepts are not independent of one another and an analysis of the relationships between concepts within the field of energy fuel cycle and the arrangement of them into concept systems is a prerequisite of a coherent vocabulary. Such an analysis was used in the development of the vocabulary specified in this document. Since the concept diagrams employed during the development process can be helpful in an informative sense, they are reproduced in [A.3](#).

A.2 Concept relationships and their graphical representation

A.2.1 General

In terminology work, the relationships between concepts are based on the three primary forms of concept relationships indicated in this Annex: the hierarchical generic (see [A.2.2](#)), partitive (see [A.2.3](#)), and the non-hierarchical associative (see [A.2.4](#)).

A.2.2 Generic relation

Subordinate concepts within the hierarchy inherit all the characteristics of the superordinate concept and contain descriptions of these characteristics which distinguish them from the superordinate (parent) and coordinate (sibling) concepts, e.g. the relation of mechanical mouse, optomechanical mouse, and optical mouse to computer mouse.

Generic relations are depicted by a fan or

Generic relations are depicted by a fan or tree diagram without arrows (see [Figure A.1](#)).

EXAMPLE From ISO 704:2022, 5.6.3, Example 2.

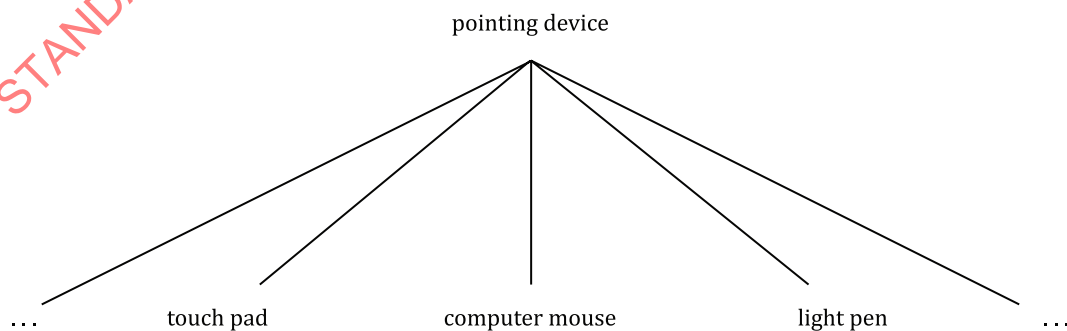


Figure A.1 — Graphical representation of a generic relation

A.2.3 Partitive relation

Subordinate concepts within the hierarchy form constituent parts of the superordinate concept, e.g. mouse button, mouse cord, infrared emitter, and mouse wheel can be defined as parts of the concept optomechanical mouse. In comparison, it is inappropriate to define red cord (one possible characteristic of mouse cord) as part of an optomechanical mouse.

Partitive relations are depicted by a rake without arrows (see [Figure A.2](#)). Singular parts are depicted by one line, multiple parts by double lines.

EXAMPLE From ISO 704:2022, 5.6.3, Example 2.

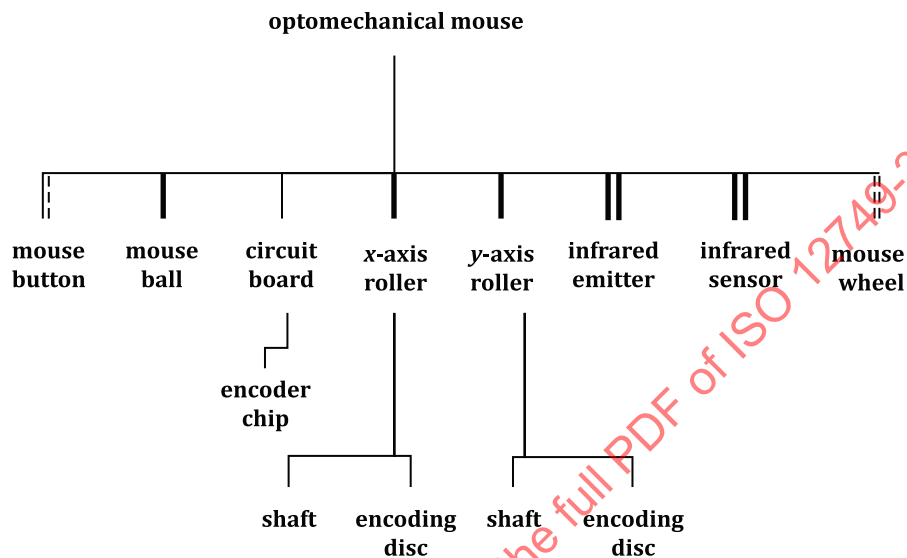


Figure A.2 — Graphical representation of a partitive relation

A.2.4 Associative relation

Associative relations cannot provide the economies in description that are present in generic and partitive relations, but are helpful in identifying the nature of the relationship between one concept and another within a concept system, e.g. cause and effect, activity and location, activity and result, tool and function, and material and product. Besides, associative relations are the most commonly encountered in terminology practical work as they correspond to the concepts relations established in the real world.

Associative relations are depicted by a line with arrowheads at each end (see [Figure A.3](#)).

EXAMPLE From ISO 704:2022, 5.6.3, Example 1.

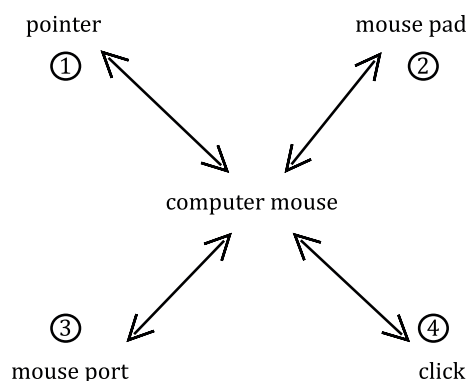


Figure A.3 — Graphical representation of an associative relation

A.3 Concept diagrams

Figures A.4 to A.9 show the concept diagrams on which the thematic groups of the nuclear fuel cycle vocabulary are based.

Notations in the following diagrams show the position of each concept according to generic, partitive, and associative relationships.

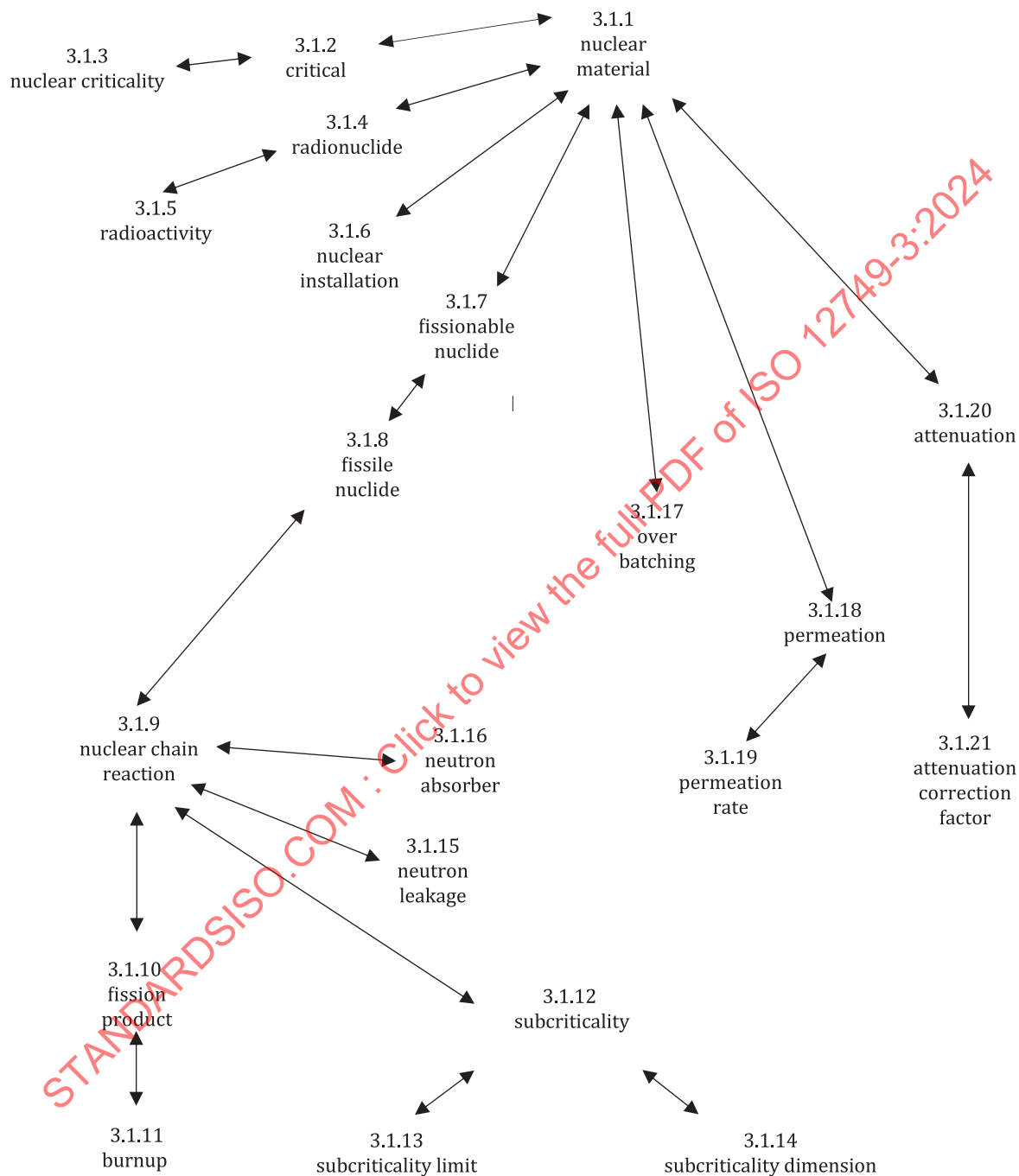


Figure A.4 — Terms related to nuclear materials (3.1)

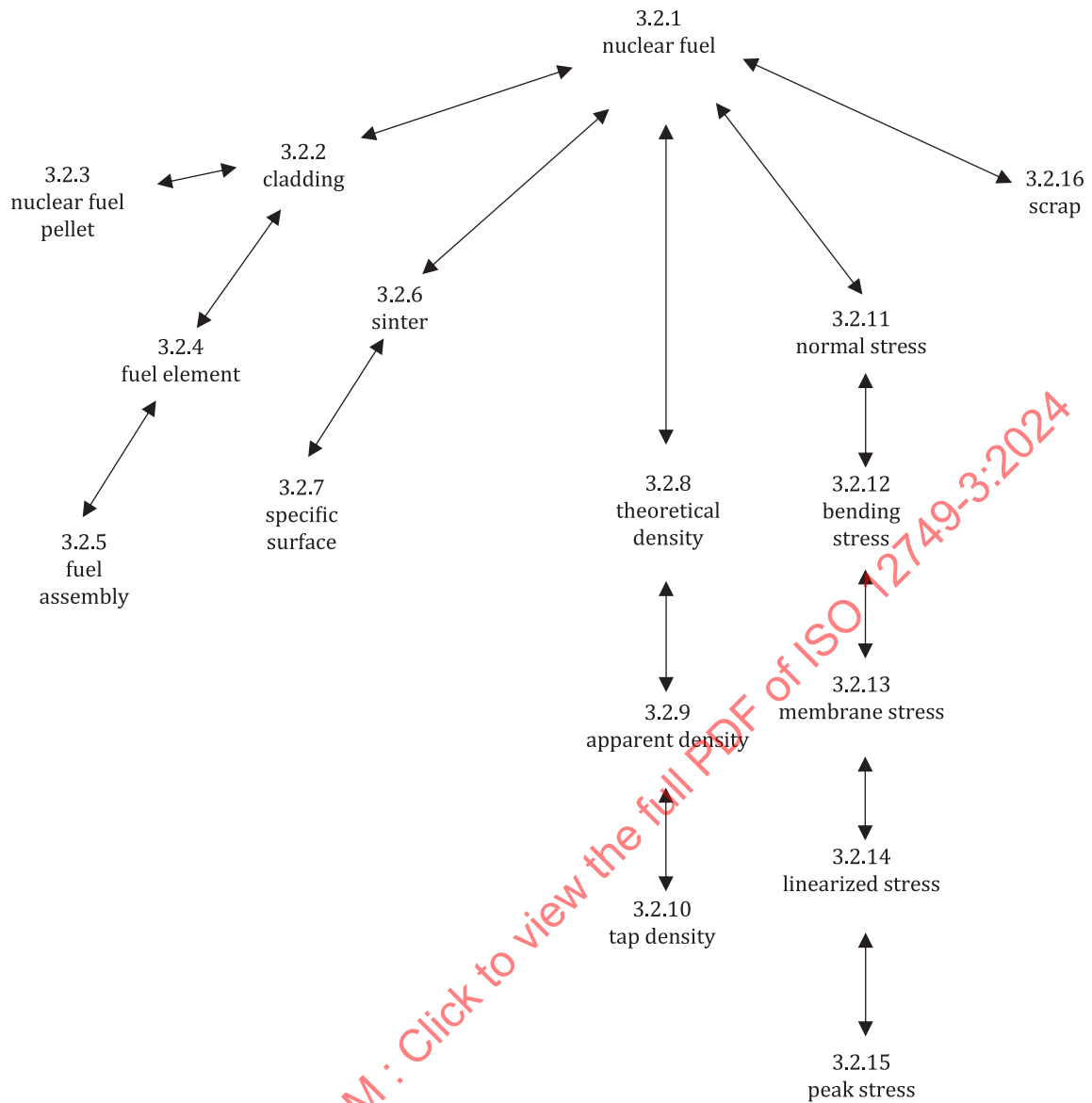


Figure A.5 — Terms related to nuclear fuels (3.2)

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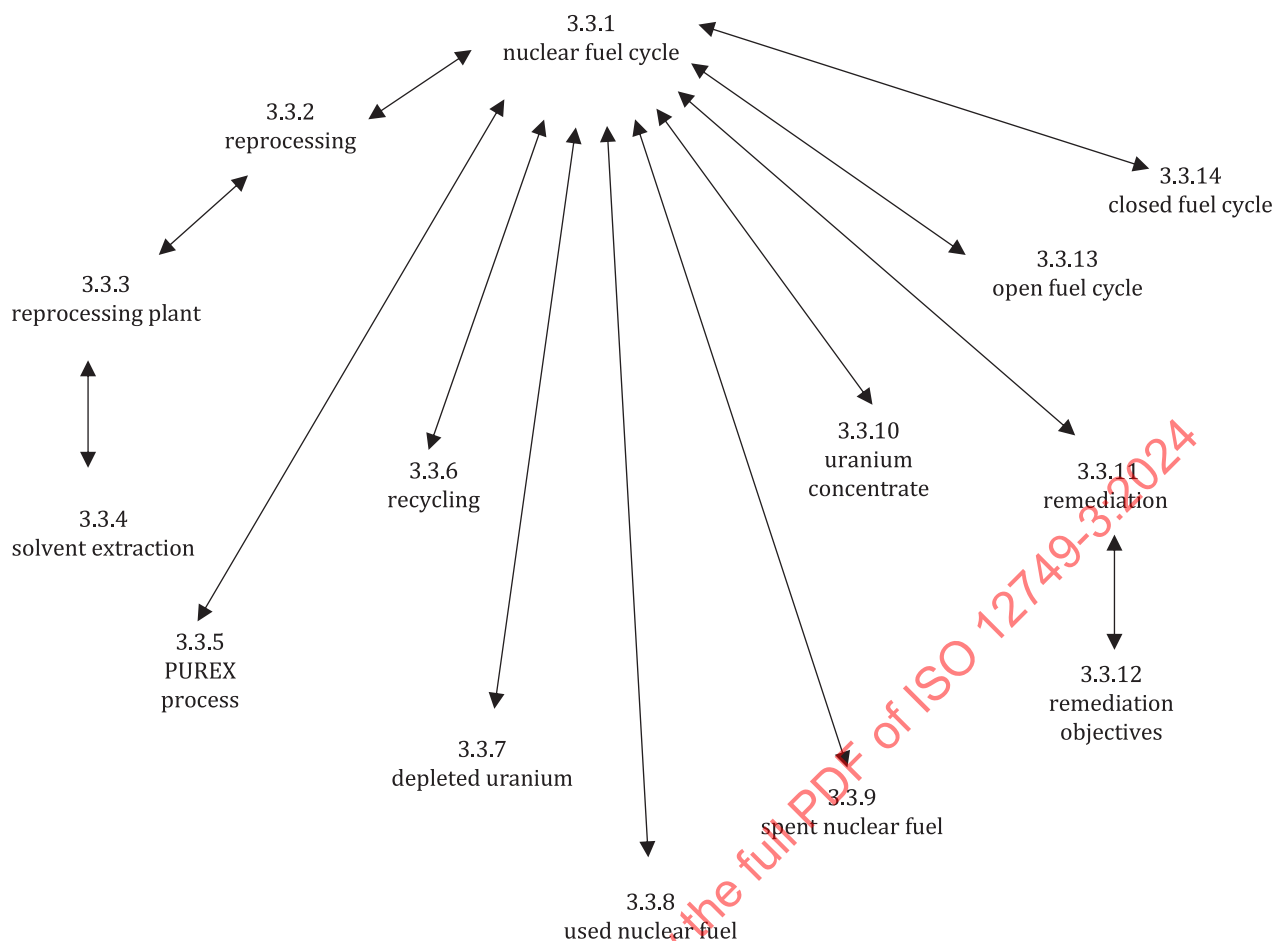


Figure A.6 — Terms related to nuclear fuel cycle (3.3)

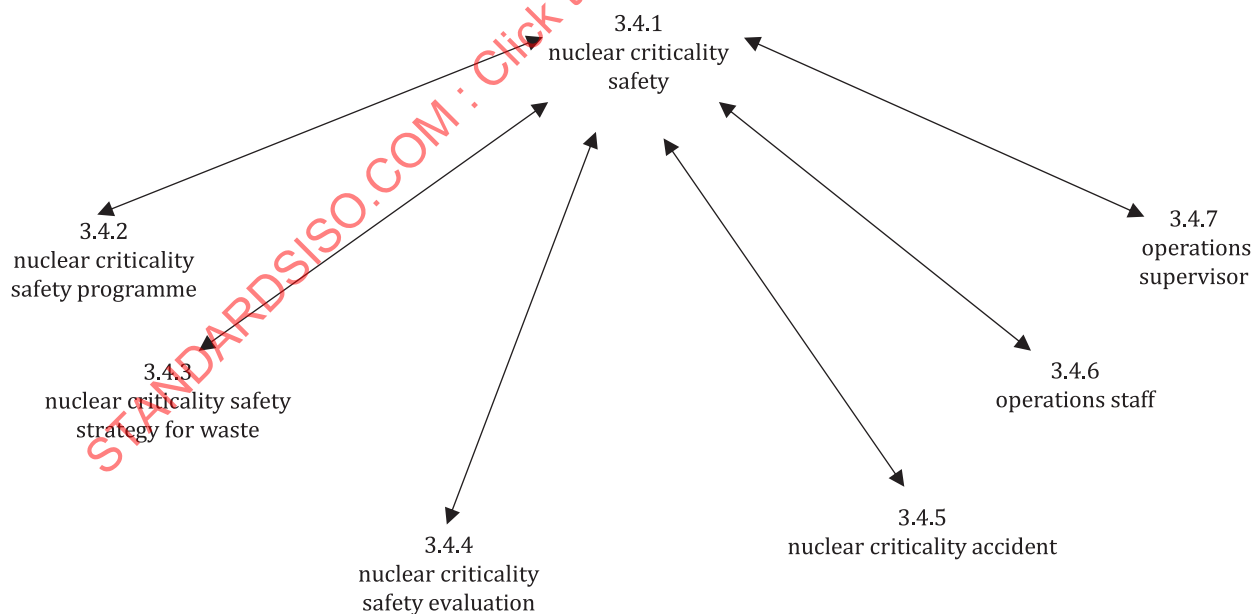


Figure A.7 — Terms related to nuclear criticality (3.4)