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Glossary for Cigeo 2015 Deliverables

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Contents

This document defines the terms used in the various deliverables, including the Safety Options Reports and the Retrievability Technical Options Report.

Some of the original French terms appear in official lists of nuclear terminology and are published in the Official Journal of the French Republic. Others are taken from the fourth edition of the *Dictionnaire des sciences et techniques nucléaires*.

The document is divided into two parts, one providing definitions of terms used, the other explaining the main abbreviations used.

DEFINITION OF TERMS

Terms	Definitions
Abnormal configurations	In the safety-criticality context, study configurations used to demonstrate the subcriticality of incident and accident situations chosen to demonstrate nuclear safety. The values of the parameters not chosen for the purpose of checking criticality are chosen for these configurations in order to maximise the resulting effective multiplication factor.
Acceptance	Process whose objective is to check that the waste packages delivered at Cigeo meet all package acceptance criteria drawn up by Andra.
Acceptation	Action by which the operator of a radioactive waste disposal facility recognises that a family or subfamily of waste packages complies with the acceptance specifications of Cigeo.
Actinides	Natural or artificial radionuclides with an atomic number between 89 (actinium) and 103 (lawrencium)
Active tests	Tests involving equipment or packages containing radioactive substances.
Activity important for protection	Activity important for the protection of the interests stated in Article L.593-1 of the French Environmental Code (public safety, health and welfare, and the protection of nature and the environment), i.e. activity that takes part in technical or organisational provisions stated in the second paragraph of Article L.593-7 of the Environmental Code or that is liable to impact them.
Adaptability	Ability to modify the facility in response to new design-basis assumptions (such as changes to the inventory), involving significant modifications to existing equipment or the construction of new structures
Advection	All the movements of a fluid under the effect of density, temperature or pressure gradients.
Air return	Air from construction or operation worksites.
Air return drift	Drift housing the system that carries the air extracted from the ILW-LL cells to the shaft dedicated to air extraction.

Terms	Definitions
ALARA	ALARA is the acronym of "As Low As Reasonably Achievable". When applied to the protection of workers and the public against ionising radiation, the ALARA principle indicates a constrained optimisation process consisting in finding the lowest reasonably achievable exposure level that takes into account the technical, economic and social factors involved.
Anomaly	Triggering event or deviation.
Aquifer	Body (layer or massif) of water-permeable rock that has a less permeable substrate and sometimes less permeable rocks covering it, and includes a saturated area that allows a significant water flow through the underground layer and the capture of significant quantities of water. The term refers to both the entire solid medium (the container) and the water that it contains. Depending on its fill factor, an aquifer may include an unsaturated area.
Architecture on completion	Representation of the underground parts of the disposal facility, corresponding to the complete development of all planned excavations and structures
Backfill	Material used to fill in the surface-to-bottom connections and the disposal drifts, with the exception of the sections occupied by the sealing structures
Barrois (limestone)	Limestone formation of the uppermost Kimmeridgian-Tithonian. This formation is outcropping on the Plateau de Bure.
Bentonite	Argillaceous rock mainly consisting of argillaceous minerals of the smectite group. It was named after Fort Benton (USA), the site of a deposit of this type of clay. This swelling clay, which has a high water retention capacity, can be used in various forms (blocks, pellets or powder) and may be mixed with sand to produce parts of the disposal facility sealing structures (for cores)
Biosphere	All ecosystems, including all living organisms and the environment in which they live.
Bituminised sludge	Sludge resulting from coprecipitation operations in liquid radioactive effluent treatment plants and conditioned in bitumen.
Bonded water	Water involved in a physicochemical bond with a body other than itself.
Bottom (of a geological formation)	Lower limit of the sedimentary geological formation.

Terms	Definitions
Callovo-Oxfordian	Geological formation dating from the Jurassic age and 155 million years old. It is found in argillaceous form in the east of France. This is the formation in which the Cigeo underground facility, in particular the disposal cells, is located.
Carcinogenic substance	Substance classified under property hazard code H7 in Appendix I of Article R.541-8 of the French Environmental Code.
Cask (transfer cask)	Shielded mobile container used to transfer disposal packages within the installations, in compliance with the radiation protection and containment rules.
Cell head	Part of the disposal cell located between the last waste package put in place and the access drift.
Cell retrievability levels	Successive closure states (from partial to definitive) of the disposal facility, used to represent the increase in the degree of effort required in order to withdraw the packages.
Clay rock	Rock mainly consisting of argillaceous minerals indurated through compacting and without a distinct bed. By extension, this term indicates the Callovo-Oxfordian formation in which Cigeo is located.
Cliff edge effect	Major discontinuity in the scenario concerned, resulting in the accident being significantly and irreversibly aggravated (significant increase in release, significantly shorter time before the undesirable situations occur, etc.).
Closure structures	Structures complementing the geological barriers in order to ensure the proper operation of the repository after its closure, i.e., in order to ensure its passive safety.
Co-disposal	Disposal within the same cell of different types of packages which are compatible in terms of safety functions during operation and after closure, and in terms of their geometry.-
Colloid	Substance in the form of a liquid or gel containing solid particles (micelles) in suspension that are small enough for the mixture to be homogeneous. The particle size can range from nanometres to micrometres.
Complexing agent (ligand)	Chemical species able to bond to a metal ion in order to form a complex – in other words, a molecular structure (neutral or charged). The metal ions of interest in Cigeo are cations of radioactive and/or toxic chemical isotopes for which the formation of a complex is liable to favour their transfer to the environment.

Terms	Definitions
Compliance	A facility is compliant with its safety demonstration when it meets all of the safety requirements applicable to it in this respect.
Conceptual models	Models designed to represent the state of the geological medium or the behaviour of one or more components of the repository during their evolution. They therefore describe the thermal, hydraulic, mechanical and chemical processes and can be used in safety analyses and the associated numerical simulations.
Conditioning	Generated radioactive waste can be in raw, gaseous, liquid or solid form. For management purposes, this waste must be conditioned, which entails producing "waste packages". Conditioning can be defined as all the operations required to place the waste - possibly after treatment - in a container where it may or may not be embedded in a matrix material to form a waste package. Radioactive waste is therefore transformed into a waste form suitable for transport, storage or disposal. Conditioning may include compaction, embedding, vitrification, cementation, bituminisation and containerisation.
Conditioning material volume	Volume of material (other than waste) used by the producers to condition the waste in a primary package.
Conservative model (or reasonably cautious model)	Model for which it can be demonstrated that its use tends to overestimate the repository impact in relation to the results that would be obtained by taking account of all of the pertinent phenomena within the considered range of variation of the parameters.
Conservative value	Value that, of all those resulting from the studies and measurements, can be used to obtain a calculated impact situated in the high value range of all impacts that can in principle be calculated (all other parameters remaining as defined).
"Construction" logistics support zone	Zone in the underground facility whose purpose is to provide support for underground structure construction and fitting-out operations.
"Construction" zone	Part of the facility in which construction work is carried out. It is physically separated from the operating zone.
Containment	Confining radioactive substances within a defined space by means of a set of measures designed to prevent these substances from being dispersed in unacceptable quantities outside that space. By extension, the set of measures taken in order to confine them within that space.

Terms	Definitions
Containment of radioactive substances	Confining radioactive substances within a defined space by means of a set of measures designed to prevent these substances from being dispersed in unacceptable quantities outside that space. The radioactive substances are contained by placing one or more sufficiently independent barriers in succession (and, if necessary, a dynamic containment system) between these substances and humans and the environment.
Containment sector	Volume whose characteristics limit the radioactive or hazardous substances liable to harm the interests mentioned under Article L.593-1 of the French Environmental Code being dispersed outside the volume concerned in case of fire.
Containment wall	Seal component providing mechanical support for the swelling clay-based core.
Conventional waste zone	Zone of the facility that has not been defined as a "potential nuclear waste production zone" by the waste zoning plan mentioned in Article 6.3 of the Order of 7 February 2012
Corrosion	Physicochemical interaction between a material (often metallic) and its environment, thereby changing the properties of the material and potentially resulting in a significant degradation of its function, the surrounding medium and the technical system of which they are part.
Criticality	Condition of a medium in which a nuclear chain reaction is taking place.
Criticality hazard	Risk of triggering an uncontrolled fission chain reaction in an initially sub-critical medium. A fissile medium becomes critical when the rate of neutron production (through the fission of the material concerned) is exactly equal to the neutron disappearance rate (absorption and external leaks).
Cross cut	Short drift that connects two or more parallel drifts together.
Danger quotient (DQ) or Risk index (RI)	Ratio between the exposure dose (or concentration) and the reference dose (or concentration), used to characterise the threshold effect risk resulting from the action of toxic substances following their absorption and distribution in different parts of the human body.
Defined requirement	Requirement assigned to an element important for protection (EIP) so that it completes the planned function, with the expected characteristics, in the demonstration mentioned in the second paragraph of Article L.593-7 of the French Environmental Code, or to an activity important for protection so that it meets its objectives with regard to this demonstration.

Terms	Definitions
Degraded operation	Operating regime other than normal operation, whose limited-term acceptability with regard to the interests mentioned under Article L.593-1 of the French Environmental Code is demonstrated for the purposes of the safety demonstration.
Demonstration of nuclear safety	All the elements contained or used in the Preliminary Safety Analysis Report and the safety analysis reports mentioned in Articles 8, 20, 37 and 43 of the Decree of 2 November 2007 relating to basic nuclear installations and to checks on nuclear safety, the transport of radioactive substances and contributing to the demonstration mentioned in the second paragraph of Article L.593-7 of the French Environmental Code, which prove that accident risks, radiological or otherwise, and the degree of their consequences are, given the state of knowledge, practices and environmental vulnerability of the facility, as low as possible in acceptable economic conditions
Demonstrator	Inactive structure (i.e., not containing radioactive waste packages) of the underground facility that is used for tests, feasibility demonstrations, component and equipment development, and training operating and monitoring teams. It is designed to represent the industrial structures as accurately as possible for the purpose of demonstrating their industrial feasibility or showing that these structure meet the required performance levels in a physical environment representative of the planned operating conditions. Disposal cell, sealing and hydraulic cut-off demonstrators are planned for Cigeo.
Deviation	Non-compliance with a defined requirement or non-compliance with a requirement fixed by the integrated management system of the operator and liable to affect the provisions stated in the second paragraph of Article L.593-7 of the French Environmental Code.
Diagenesis	All biochemical and physicochemical changes that affect a sediment after it is deposited (before it becomes metamorphic) and result in it transforming into rock.
Diffuse release (or diffuse discharge)	Effluent discharge not channelled to a monitored outlet
Diffusion (of a solute in a porous medium)	Physical phenomenon linked with the molecular agitation through which a solute moves in a porous medium. This molecular agitation results in the solutes transferring from the high-concentration areas to the low-concentration areas.
Diffusion coefficient (of a solute)	Coefficient characterising the mass flow of a solute moving under the effect of a concentration gradient of the solute concerned (unit = m^2/s). See Diffusion

Terms	Definitions
Direct disposal	Disposal of the ILW-LL packages delivered by their producer without being inserted into a disposal container first.
Disadvantages	Impacts of the facility on health and the environment due to water sampling and discharges, noise and vibrations, odours or airborne dust.
Dispersion	Release of radioactive substances outside a determined space. Dispersion occurs if containment is lost.
Disposal cell	In a disposal facility, the elementary structure designed to receive radioactive waste packages.
Disposal container	Closed handling recipient in which one or more primary packages are placed prior to disposal. Consisting of a body and a lid, existing disposal containers are made of concrete or steel.
Disposal package (CS)	Radioactive waste package that can be placed, as is, in the disposal facility. The primary waste packages are liable to be supplemented by an overpack from the waste producers.
Distribution factor (Kd).	Coefficient characterising the distribution of a chemical element between a solid phase and a liquid phase in equilibrium, consisting of the value of the ratio between the quantity of the element per unit of weight of the solid phase and the concentration of the element in solution in the liquid phase (unit = volume/mass, e.g., mL/g)
Disturbance	Phenomenon modifying a disposal element in relation to its state or its natural evolution.
Disturbed zone	Generic term indicating an argillitic zone that may be affected by geochemical perturbations (oxidant, iron-clay or microbiological reactions), or even thermal disturbance.
Dogger	Mesozoic (Secondary) geological period corresponding to the Middle Jurassic period, between 175 and 154 million years old (SGF 2002).
Dose rate	Quotient of the dose variation during time interval dt by time interval dt, in grays per second, although the unit frequently used in radiation protection is micrograys per hour (µGy.h-1)
Drainage basin	Catchment area drained by a water course and its tributaries. Every catchment area is geometrically defined by reference to a given place in a water course (the mouth or a given point), by means of a contour (groundwater dividing line) and a surface area.

Terms	Definitions
Earthquake	Earth tremor or series of tremors corresponding to mechanical waves produced deep below the ground due to tectonic strains being relaxed during ruptures and slippage along the fault planes.
Easily flammable substance	Substance classified under property hazard code H3-A in Appendix I of Article R.541-8 of the French Environmental Code (note that there is a partial overlap with the hazard category identified as "substance or mixture which, in contact with water, emits flammable gases" in the European CLP regulation).
Ecotoxin	Substance classified under property hazard code H14 in Appendix I of Article R.541-8 of the French Environmental Code.
Effective dose	Sum of the equivalent doses received by the various organs and tissues of a person, weighted by a factor specific to each tissue or organ (unit: sievert).
Effluent	Any liquid or gaseous fluid produced by the facility and liable to be directly or indirectly discharged into the receiving environment.
Element important for protection (EIP)	Element important for the protection of the interests mentioned in Article L.593-1 of the French Environmental Code (public safety, health and welfare, and the protection of nature and the environment), i.e., structure, equipment, system (programmed or otherwise), hardware, component or software present in a basic nuclear installation or placed under the responsibility of the operator and performing a function required in the demonstration mentioned in the second paragraph of Article L.593-7 of the Environmental Code or checking that this function is performed.
Emission	Direct or indirect introduction of substances, vibrations, heat or noise into the air, water or soil from the facility's point or diffuse sources.
Engineering Contractor	Legal person governed by private law or group of legal persons governed by private law, to which the project owner entrusts a task that must provide an architectural, technical and economic answer to the programme concerned. In particular, it may be entrusted with the following design and support elements: conceptual design studies, preliminary design studies, project studies, etc.
Environmental quality standard	Concentration of a pollutant or of a group of pollutants in the water, sediments or biota that must not be exceeded in order to protect human health and the environment.
Equivalent dose	Dose absorbed in a tissue or organ multiplied by a weighting factor that takes into account the biological effects linked with the type and energy of the radiation (unit: sievert).

Terms	Definitions
Erosion	Set of phenomena resulting in the surface and shallow ground being removed, thereby modifying the relief and the geomorphological surface. They combine chemical processes (dissolution and water-induced alterations) and mechanical processes from different sources (gravity, water, wind, ice, etc.) that cause the rock to fragment and remove the debris. These phenomena depend on the climate, the rock type and landforms concerned.
Exothermic waste	Waste whose heat production requires disposal in micro-tunnels.
Explosive substance (or explosive)	Substance classified under property hazard code H1 in Appendix I of Article R.541-8 of the French Environmental Code.
Extreme situation	Situation, as defined within the technical scope of the specifications, to be adopted for stress tests (ECS) on nuclear facilities.
Facies	All the characteristics of a rock that attach it to a sedimentation field.
Fault	Break with relative displacement (throw) in both resulting compartments. The length of a fault can vary from a few metres to several hundred kilometres. Its throw can also vary (from a decimetre to several kilometres). Tension fractures and smaller throws are called “microfaults”.
Feared situation	Degraded state of the facility that should be avoided.
Final radioactive waste	Radioactive waste that can no longer be processed by extracting recoverable materials or reducing its polluting or hazardous character under current technical and economic conditions.
Fire sector	Volume delimited by walls so that a fire occurring within it cannot spread outside it or a fire occurring outside it cannot spread into it during a sufficient time to allow the fire to be extinguished.
Fire zone	Volume delimited by borders (geographical separation or walls) so that a fire occurring within it cannot spread outside it or a fire occurring outside it cannot spread into it during a sufficient time to allow the fire to be extinguished.
Fissile	Term used to describe a nucleus that is capable of undergoing fission through interaction with neutrons in all energy ranges, including thermal neutrons.
Fissile material	Material composed of chemical elements of which some isotopes are fissile.

Terms	Definitions
Fissile medium	Physicochemical medium whose contents include fissile material.
Flammable substance	Substance classified under property hazard code H3-B in Appendix I of Article R.541-8 of the French Environmental Code.
Flexibility	Ability of the facility to adapt to changes in the industrial programme (reception schedule, reception flows, date of partial closure, changes in reference inventory package conditioning methods).
Fracture	Break in the rock, irrespective of its origin or size (extension, thickness and movement).
Free liquid	Any liquid present in the package (and liable to escape from it without being exuded under pressure).
Fuel assembly nozzle	Machined metal part located at each end of a fuel assembly and providing its connection with the equipment inside the vessel.
Functional analysis	Process consisting in identifying, breaking down, characterising, sequencing and ranking the functions of a product.
Future package	Package for which production has not yet started. A distinction will be made between future packages for which significant progress has been made in defining waste conditioning, and those for which conditioning is still at the research stage.
General corrosion	Corrosion progressing over the entire area of the material exposed to the corrosive medium.
Geodynamics	The field of geological sciences that involves the evolution of the terrestrial system. Term used to indicate the causes of the natural evolution of the globe, the region and the site resulting from internal (tectonic) and/or external (climatic and geomorphological) evolution processes.
Geological medium	In the case of the disposal problem, the geological formations in the Meuse and Haute-Marne region of France. These consist of Barrois limestone, Kimmeridgian marls, Oxfordian limestone, Callovo-Oxfordian clay rock and Dogger limestone. In fields requiring a large-scale view (internal geodynamics and hydrogeology), the geological medium in question extends as far as the Triassic, or even to all sedimentary formations as far as the bedrock.
Geomorphology	Study of the origin and temporal evolution of the topographical surface (landforms and outcrops of geological layers) due to erosion-deposition processes (mechanical and chemical) and climatic actions.

Terms	Definitions
Glaciation	Period during which large ice caps form at high latitudes. Defined at the global scale, it implies a cold, arid climate at the current position of France but not the presence of glaciers outside mountainous regions ("periglacial" climate).
Hardened safety core	Set of robust material and organisational measures whose purpose, for the extreme situations studied in stress tests (ECS), is to prevent a serious accident or limit its progression, limit massive radioactive release, and enable the operator to perform the tasks for which it is responsible in emergency situations.
Hazardous substance	Substance, preparation or mixture that meets the criteria relating to the physical hazards, health hazards or environmental hazards defined by the Order of 20 April 1994 as amended.
High-level waste	High-level waste (HLW) mainly comes from fuel reprocessing. The activity level of this waste is around several billion becquerels per gram.
Horizon	Particular level within a geological formation.
Hulls	Waste consisting of cladding fragments left following the chemical dissolution of the fuel element cladding sections obtained by shearing the fuel rods or assemblies as part of their processing.
Human intrusion	Human action that occurs after the disposal facility is closed and which is liable to a create an access route to the repository.
Hydraulic conductivity	Ability of a material to allow water to pass through it. Hydraulic conductivity is sometimes wrongly called "permeability" or the "permeability coefficient"
Hydraulic cutoff (of the damaged zone around a seal)	Seal component dividing some or all of the damaged area of the surrounding rock in order to reduce water flows along the seal. In practice, it is made in the form of a groove filled with a swelling, low-permeability material.
Hydraulic gradient	Difference in hydraulic head between two points, relative to the distance between them.
Hydraulic head	Sum of the water pressure at a given point, expressed in metres, and the level of this point counted relative to a benchmark (generally, the NGF level)
Hydraulic overpressure	Difference between the natural hydraulic load that can be attributed to uncoupled hydrogeological processes (convective flows in accordance with Darcy's Law) and the estimated actual hydraulic load (measured or simulated)

Terms	Definitions
Hydrogeology	Study of water flows in geological formations, i.e. underground.
Hydrology	Study of the organisation and flows of surface waters (rivers, lakes and surface aquifer layers).
Hypothetical reference group	These groups are representative of the individuals liable to be subjected to the highest exposure levels after the repository is closed. They are established on the basis of hypotheses specific to the envisaged scenarios.
Immobilisation matrix	Material used to immobilise radioactive waste to obtain a compact stable waste form that cannot be physically dispersed.
Impact calculation	Quantified assessment of radionuclide and toxic element transfer from the disposal packages to the outlets, via different transfer pathways (operating phase and post-closure phase). The impact is characterised by the effective committed dose (for the radiological impact) and by excessive individual risks or danger quotients (for the chemical impact), based on concentrations measured at the outlets.
Impact study	Study of the environmental impact of a project. It is provided for under Article L.122-1 of the French Environmental Code, and its contents are defined under Article R.122-5 of the same code.
Inactive tests	Tests involving equipment or packages that do not contain radioactive substances. Tests and inspections of radiation protection equipment are considered as inactive tests.
Incident or accident	Any unplanned event that occurs during normal or degraded operation and which is liable to degrade the protection of the interests mentioned under Article L.593-1 of the French Environmental Code; the potential or actual consequences of an accident are more serious than those of an incident.
Independent anomalies	Anomalies that do not have a direct, common cause.
Industrial pilot phase	Project phase that begins when the first tests in the underground facility commence and ends with the transition to normal operation. Andra will issue a report on this phase (operation, safety, reversibility). The transition to normal operation will follow a process to be validated by ASN and stakeholders, in accordance with regulations that are still to be defined.
Infectious substance	Substance classified under property hazard code H9 in Appendix I of Article R.541-8 of the French Environmental Code.

Terms	Definitions
Interests to protect	Public safety, health and welfare, and the protection of nature and the environment.
Intermediate-level long-lived waste	Intermediate-level long-lived waste (ILW-LL) mainly comes from fuel reprocessing and activities involved in the maintenance and operation of processing plants. It includes structural waste from fuel assemblies, end caps and cladding hulls, technological waste (used tools, equipment, etc.) and waste resulting from the treatment of effluents, such as certain sludges. The activity of this waste is from around one million to one billion becquerels per gram.
Internal failure	Malfunctions, faults or damage in an element of the facility or present in the facility, including those resulting from inappropriate human actions.
Internal hazard or external hazard	Any event or situation that begins, respectively, inside or outside the basic nuclear installation and which can directly or indirectly damage elements important for protection or threaten compliance with the defined requirements
Intrusion scenario	Scenario describing a human intrusion.
Joint	Fracture in the rock, with no movement of the two separate parts.
Karst	Cavities varying widely in size and natural underground drifts occurring in limestone rock. They are created as the limestone is dissolved by rainwater containing carbon dioxide.
Kinematic porosity	Fraction of the total porosity liable to be taken up by a convective flow.
Licence	License authorising the creation or dismantling of a basic nuclear installation in accordance with Articles L.593-7 and 28 of the French Environmental Code respectively.
Liner	Component of an underground structure providing mechanical stability.
Localised corrosion	Corrosion mainly concentrated on localised sites of the surface of a material. It may, for example, appear in the form of pits, inter-granular furrows or cracks.
Logging	Continuous measurement of a physical characteristic throughout the length of a borehole using a sensor moved within the borehole.

Terms	Definitions
"Low pH" concrete	Concrete containing a large quantity of mineral additives in place of clinker in order to obtain an interstitial solution with a lower pH than standard concretes (which have a pH of around 11) and limit the alkaline disturbance effects of the concrete, particularly upon the argillaceous materials, after the disposal facility is closed
Matrix	Embedding or immobilisation material with which waste is bonded to limit the spread of radioactive substances.
Maximum physically possible earthquake (SMPP)	The strongest earthquake liable to be caused by a given fault or to occur in a given earthquake-tectonic zone.
Maximum value	Highest value of a parameter that can match the highest measurements and/or calculation results.
Meuse/Haute-Marne area	Area 40 km from east to west and 60 km from north to south in which the underground laboratory is located.
Meuse/Haute-Marne site	Perimeter of the construction permit for the underground research laboratory. It is located at the border between the Meuse and Haute-Marne departments.
Minor actinides	Some actinides, mainly neptunium, americium and curium, are produced through nuclear fuel irradiation. Uranium and plutonium are not minor actinides.
Moderator	A material or medium intended to slow down the neutrons generated by the nuclear fission.
Monitoring	Continuous or periodic systematic measurement of a number of values in order to i) check the operation of the facility as soon it has been constructed, throughout the entire operational phase and following closure in order to check that the facility remains within the defined operating range, ii) identify any discrepancies in the operation of the facility, and iii) check the package removal capacity.
Monitoring action	Set of operations that measure, analyse and interpret the behaviour of a structure. This term does not distinguish between the data acquisition objective and the measuring process itself (investigation, surveillance, characterisation, observation, etc.).
Muck	Rocks removed during excavation and earthworks.
Muck piles	Part of the surface facilities intended for the disposal of muck and material excavated when constructing underground facilities. By extension, material disposed of on the surface.

Terms	Definitions
Mutagenic substance	Substance classified under property hazard code H11 in Appendix I of Article R.541-8 of the French Environmental Code.
National Inventory of Radioactive Materials and Waste	Inventory of all the radioactive materials and waste currently in France, with forecasts for their future production. The inventory is updated every year and published by Andra every three years.
Near-field	Part of a radioactive waste disposal facility (including the host rock in its immediate environment) that is subject to significant thermal, hydraulic, mechanical and chemical disturbances caused by the presence of the disposal facility, as opposed to the far-field area.
Non-exothermic or slightly exothermic waste	Waste that, because of its heat production level, can be disposed of either in micro-tunnels or tunnels.
Normal configurations	In the safety-criticality context, study configurations used to demonstrate the subcriticality of normal operation and of operation in degraded mode. The values of the parameters not chosen for the purpose of checking criticality are chosen for these configurations in order to maximise the resulting effective multiplication factor.
Normal evolution scenario	After the disposal facility is closed, the set of disposal situations defined by the following: a reference situation, said to be “phenomenological”, whose processes, events, hypotheses and data are defined on the basis of the best scientific and technical knowledge available; sensitivity studies designed to approach the limits of the normal evolution scenario by including all types of uncertainties.
Normal operation	Facility operating regime that includes all normal states and operations of the facility, including scheduled maintenance or outage situations, irrespective of whether or not radioactive substances are present; the term “normal operation” also covers any situation defined as such in the safety demonstration.
Nuclear operating zone (or nuclear zone)	Zone in which nuclear materials are or have been present and/or operations are performed upon packages containing waste or nuclear materials, or which contains equipment that has worked in a potentially contaminated zone.
Nuclear operator	Individual or company that operates a basic nuclear installation, irrespective of whether its situation is normal, or which has submitted a licence application provided for in Article L.593-7 of the French Environmental Code with the aim of operating such an installation.

Terms	Definitions
Nuclear safety	Set of technical and organisational measures relating to the design, construction, operation, shutdown and dismantling of basic nuclear installations, as well as to the transport of radioactive materials, conducted with a view to preventing accidents or mitigating their effects.
Nuclide	Nuclear species characterised by its atomic number Z and its mass number A, equal to the number of nucleons in its nucleus.
Observation	Investigation of a fact or process in order to understand it better and in particular, to identify its cause. It forms part of a continuous improvement process ("responsible operator" process complying with Art. 2.7.2 of the Order of 7 February 2012 on basic nuclear installations.
Operating zone	Zone in which conventional or nuclear operations are carried out.
"Operating" logistics support zone	Zone in the underground facility whose purpose is to provide support for disposal and, when applicable, package removal operations.
Organic disturbance	All the transformations affecting the solids and fluids due to the plume of organic molecules from the disposal of ILW-LL waste. In particular, the plume can modify the migration of certain radionuclides and toxic chemicals through complexation.
Outlet	Place (in the surface, subsurface or deep layers) through which the water, which may be laden with radioactive substances, can leave these layers and return to the biosphere.
Overall primary package volume	Overall volume, corresponding to the cubic displacement of the primary package.
Oxfordian limestone	Mainly calcareous geological formation that begins with the Middle Oxfordian and ends with the Basal Kimmeridgian.
Package being produced	Waste package for which conditioning has been defined and a production specification exists.
Package filling material	Material used to immobilise radioactive waste. Its purpose is to mechanically immobilise the waste or to ensure that the package is completely full.
Performance	Characterises a component, item of equipment or system. Established by the designer with regard to user-defined criteria relating to a function.

Terms	Definitions
Permeability	Parameter characterising the flow rate of a fluid (water or gas) flowing through a porous medium subject to a hydraulic head gradient (water) or pressure head gradient (gas).
Pessimistic model	Model that is not based on an understanding of the phenomenology, even empirical, but which is used solely for overestimating repository impact with a degree of certainty.
Pessimistic value	Value that does not refer to phenomenological knowledge but which is chosen conventionally to lead with all certainty to an impact greater than that calculated with possible values.
Phase	Set of surface buildings and/or underground structures constructed by committing to an investment tranche, i.e. a part of the total cost of ownership.
Phenomenological model	In absolute terms, a model based on the most complete understanding of the phenomenon to be modelled, and whose ability to reflect the results of direct or indirect measurements has been verified. By comparison with the other models available, it may be the one that best matches the reality it is intended to represent with the digital results that it obtains in the impact calculation, within the parameter variation range used in the study.
Phenomenological value	Value that, all other parameters being defined, is the value considered to offer the best balance between model results and measurement results, regardless of impact.
Planned release	Effluent release channelled to a monitored outlet, for a limited duration, and requiring special implementation conditions.
Plant	All the zones placed under the control of the operator and located on a single site.
Plug (of a disposal cell)	Closing device located at the end of a disposal cell.
Pores	Interstices (i.e., voids) in a porous medium
Porosity accessible to diffusion	Fraction of the total porosity in which a solute can move through diffusion. This is less than the total porosity in the case of anions in argillaceous rock. Porosity characterising the diffusive transfer rate.
Porous medium	Medium with connected or unconnected spaces (or pores).

Terms	Definitions
Powdery substance	Granular substance generally characterised by a mean aerodynamic diameter of less than 100 µm.
Precautionary	Indicates a measure or provision designed to ensure a particular action can still be carried out. In the reversibility or retrievability context, it consists of reserved locations or specially sized equipment or structures designed to allow or make it easier to carry out operations that are different from those initially planned by Andra in the Operations Master Plan (PDE)Definition: measures designed to ensure a particular action can still be carried out.
Precipitation	Formation of a solid phase from elements in solution.
Preparatory calculation	Assessment used to provide information justifying the physical and numerical choices made for the safety assessments (simplifications, robustness and accuracy, etc.)
Primary container	External envelope of the primary package.
Primary container total internal volume	Total internal volume corresponding to the volume delimited by the internal surfaces of the primary container.
Primary container volume	Volume made up of all the sides of the primary container.
Primary package (CP)	Waste package as taken from the waste conditioning facilities of the producers. In practice, the primary package consists of a primary container, the waste and any materials used either for the containment or immobilisation matrix, or in order to complete the filling of the container.
Primary package containment capability	Ability of the primary package to prevent the dispersion of its radiological content.
Primary package industrial volume	Volume of water displaced by the primary package. Primary package industrial volume = Primary container volume + Primary container total internal volume.
Produced package	Package for which production is completed.
Project Owner	Legal person for which the structure is built. As the main manager of the structure, it fulfils a general interest function from which it may not resign.

Terms	Definitions
Protected path	Path that must be taken by the personnel and the emergency services in order to reach the necessary places to attain and maintain a safe state at the basic nuclear installation in the event of fire.
Pyrophoric solid (or liquid) substance	Substance belonging to the "Pyrophoric solid (or liquid) substance" hazard category of EC regulation 1272/2008, or "CLP regulation".
Qualitative safety analysis of the repository	Approach used to systematically identify and assess the safety functions and uncertainties of each component and so propose appropriate management methods
Radiation protection	Set of rules, procedures and means of prevention and monitoring designed to prevent or reduce the harmful effects of ionising radiation upon people - directly or indirectly - including by the harm caused to the environment.
Radioactive effluent	Effluent whose type, origin or radiological characteristics justify the implementation of measures to protect humans and the environment against the risks or nuisances associated with ionising radiation.
Radioactive half-life	Interval of time required for one-half of the atomic nuclei of a radionuclide to decay.
Radioactive waste	Radioactive substances for which no subsequent use is planned or intended
Radioactive waste embedding	Incorporation of certain radioactive waste (that does not contain objects of a significant size) such as sludges or powdery materials in a conditioning matrix such as bitumen, a cement mortar or, more rarely, a thermosetting resin in order to obtain a compact and stable product that cannot be physically dispersed.
Radioactive waste immobilisation	Some radioactive waste is contained by immobilising it within a material in order to obtain a solid, compact and stable product that cannot be physically dispersed.
Radioactive waste package	Conditioned and packaged radioactive waste.
Radionuclide	Radioactive isotope of an element.
Ramp	Sloping surface-to-bottom connection linking the surface facilities with the underground facility of Cigeo.
Ramp zone	Zone consisting of surface facilities mainly used to receive and inspect waste packages and to prepare them for transfer into the underground facility.

Terms	Definitions
Reference biosphere	Representation of the standard biosphere (temperate, hot or cold) chosen to perform safety calculations.
Reference fissile medium	Fissile medium which, in terms of reactivity, encompasses materials liable to be present in the facility and, based on studies of normal and abnormal configurations, results in the limits associated with the most conservative criticality parameters, given the selected method of checking.
Reference group	In the radiation protection context, a group of people representative of the portion of the population most exposed to a source.
Reference inventory	Sum of the ILW-LL and HLW packages destined for disposal in Cigeo and on which the decree licensing the construction of Cigeo is based.
Removable activity	Waste package activity that can immediately be mobilised upon transfer, through being dissolved in water, for example, as opposed to the activity contained in a matrix and released gradually over time.
Repository post-closure phase	Phase beginning when no more action is required inside the underground facilities, including the connecting structures between the surface and the bottom, to ensure continued operation of the repository, for an unlimited time. It begins when sealing of the connecting structures is completed.
Repository zone	Part of the disposal facility in which the ILW-LL waste disposal sections and HLW0 and HLW1/HLW2 waste disposal sections are located.
Representative individual	Individual representative of each of the actual or hypothetical reference groups used for the impact calculation.
Requirement	Statement that stipulates a function, capability, characteristic or limitation that the product must satisfy in the given environmental conditions.
Retention	Generic term covering the physicochemical phenomena that help to slow down or limit the migration of radionuclides and toxic chemicals (sorption and precipitation).
Retrievability	Ability to remove waste packages emplaced in a deep geological formation.
Retrieval test	Test designed to gather data on all or some of a retrieval operation.

Terms	Definitions
Reversibility	Ability to offer the next generation choices as to the long-term management of radioactive waste, including, in particular, the sealing of repository structures or the retrieval of waste packages; this can be ensured in particular by the progressive and flexible development of the repository.
Robustness	Ability of an equipment item, component or system to operate in a wide range of environmental conditions (heat, cold, liquid water, humidity, dry conditions, vibration, geometric deformations, presence of contamination, ageing, response to a shock, etc.) or to be tolerant to the failure of its components or to external hazards.
Roof support	Component of an underground structure or mechanism designed to ensure the mechanical stability of the structure.
Safety analysis	Set of technical examinations intended to evaluate, on the basis of the risk assessment, the measures capable of providing safety.
Safety Analysis Report	Any version of the Safety Analysis Report mentioned under Articles 8, 20, 37 and 43 of the Decree of 2 November 2007 mentioned above and referred to as the "Preliminary Safety Analysis Report", "Safety Analysis Report" or "Preliminary Version of the Safety Analysis Report".
Safety function	Elementary function provided to ensure the safety of a basic nuclear installation (INB) or of the transport of radioactive substances in all situations taken into account in its design, construction, operation or after closure.
Safety scenario	Situation or set of situations constructed as a support for a safety demonstration. A scenario is a particular situation concerning the disposal facility (in the operational or post-closure phase) designed to cover a set of situations with similar effects.
Saline perturbation	All the transformations affecting the solids and fluids due to the plume of soluble salts (sulphates, nitrates, carbonates, phosphates, chlorides, fluorides, ammonium, etc.) from saline waste. This plume can cause a considerable increase in the ionic strength in solution as well as physicochemical changes in the medium.
Saline waste	Waste containing significant quantities of salts (e.g., sulphates, nitrates, carbonates, phosphates, chlorides, fluorides or ammonium).
Sealed source	Source whose structure or packaging prevents any dispersion of radioactive materials into the environment during normal use.
Seismic uncertainty	Possibility that a site may experience a tremor with specified characteristics. This may be described probabilistically or deterministically and established at the regional and local scales. In the latter case, it includes both site- related and induced effects.

Terms	Definitions
Self-sealing	Macroscopic process through which a damaged rock or porous medium retrieves most or all its initial permeability to water.
Sensitivity analysis	Quantitative assessment of one or more parameters and models in order to identify those whose variation has the greatest consequences for the overall assessment
Shaft zone	Zone consisting of surface facilities mainly used in underground structure excavation and construction work.
Single failure (with a common cause)	Failure that is caused by a single event affecting one or more components and which is not the result of another single failure.
Sleeve	Metallic coating on a disposal cell wall, obtained through the insertion of a tube
Social, organisational and human factors	Factors influencing human performance, such as skills, the working environment, the characteristics of tasks, and organisation.
Solubility	Parameter corresponding to the maximum saturation concentration of an element in solution, above which it precipitates in accordance with a chemical equilibrium hypothesis.
Source term	Set of characteristics of the release of radioactive substances in the environment from, for example, a nuclear installation, transport cask, radioactive waste package or disposal facility. The source term is evaluated both for normal operation and for accident scenarios, a priori or a posteriori. Its assessment almost always includes the distribution of this release over time and its distribution according to the different radionuclides.
Specifications for the acceptance of disposal packages	ASN-approved specifications with which the waste packages liable to be disposed of in a radioactive waste disposal facility must comply. These specifications are drawn up by the operator of this facility within the context defined by the applicable regulations.
Standard biosphere	Biosphere representative of the different conditions that could prevail in the biosphere, taking the major regional climatic events into account. Biospheres may, for example, be temperate, boreal or subtropical, in line with the climatic conditions used by the Köppen-Trewartha classification system.

Terms	Definitions
Start-up tests	Tests performed on elements important for protection (EIP) after they have been installed on the basic nuclear installation (INB). Their purpose is to verify the capacity of these EIPs to fulfil the functions assigned to them in the demonstration mentioned in the second paragraph of Article L. 593-7 of the French Environmental Code. Start-up tests take into account the tests carried out on the EIPs prior to installation.
Structural waste	Radioactive waste composed of metallic structures of spent fuel assemblies from water-cooled reactors. This term is also used to refer to spent fuel assemblies from sodium-cooled fast reactors.
Subcriticality	State of a subcritical medium
Substance or mixture which, in contact with water, emits flammable gases	Solid or liquid substance or mixture which, when it reacts with water, is liable to spontaneously ignite or emit flammable gases in dangerous quantities. Hazard category defined by EC regulation 1272/2008, or the "CLP" regulation.
Substance toxic to reproduction	Substance classified under property hazard code H10 in Appendix I of Article R.541-8 of the French Environmental Code.
Surface contamination	Surface activity of deposited contaminating radionuclides.
Surface facility	All of the Cigeo structures, equipment and systems installed on the surface. These are divided between two surface zones (the "ramp" zone, and the "shaft" zone).
Surface-bottom connection	Structure connecting the surface and underground facilities (ramp or vertical shaft).
Surrounding rock formations	Geological formations located on either side of the Callovo-Oxfordian clay rock formation: Dogger limestone below (underlying formation) and Oxfordian limestone above (overlying formation).
Swelling clay	Argillaceous material whose expansion depends on its saturation and which is envisaged for deep geological disposal, in particular for sealing.
Swelling pressure	Pressure built up by swelling clay when it swells due to water, at a constant volume.
System operation indicator	Quantitative parameter showing the performance and robustness of the disposal system in terms of safety functions.

Terms	Definitions
Technological waste	In nuclear installations, waste from servicing and maintenance work, such as protective clothing, glovebox gloves and replaced contaminated materials in general.
Tectonics	The internal geodynamic deformations (faults, folds, etc.) that affect the geological medium. The deformation acquisition mechanism linked with the lithosphere evolution processes at a global scale (plate tectonics).
Top (of a geological formation)	Upper limit of a sedimentary geological formation.
Total cost of ownership	Total cost of constructing (design and production), operating and maintaining, regenerating, renewing and dismantling a facility.
Total physical porosity	Volume of voids in the total volume of a porous material (rock, concrete, etc.).
Toxic element	Element liable to have harmful effects on human health in case of ingestion and/or inhalation. Note: The following toxic elements are considered at this stage: uranium, lead, mercury, antimony, cadmium, selenium, arsenic, nickel, chromium, boron, beryllium, asbestos and cyanide.
Toxic substance	Substance classified under property hazard code H6 in Appendix I of Article R.541-8 of the French Environmental Code.
Toxicological reference value (TRV)	Generic term covering the values used to establish a relationship between a dose and an effect (threshold dose-effect relationship) or between a dose and the probability of an effect occurring (thresholdless dose-effect relationship). Toxicological reference values are specific to an effect (generally, the critical effect), an exposure time (acute, subchronic or chronic) and an exposure route (oral or respiratory). They are expressed as a daily dose or a tolerable concentration in order to describe the threshold effects, or as the inverse of a dose or concentration for thresholdless effects.
Transient flow	Regime characterised by variable flow speeds over time.

Terms	Definitions
Transmissivity	Parameter, expressed in m^2/s, governing the water that flows per unit of width of the saturated area of a continuous aquifer (measured in a direction orthogonal to that of the flow), and per unit of hydraulic gradient. It is calculated by multiplying the permeability (Darcy's Law) K by the aquifer depth b, in an isotropic medium, or by multiplying the component of the permeability tensor parallel to the flow direction by the aquifer depth (orthogonally to that direction), in an anisotropic medium.
Transport	Phenomena contributing to radionuclide movement from the packaged waste. Generally, the movement of water, gas or solutes. Transport of waste packages on public highways between a production or storage site and a disposal facility.
Transposition zone	Zone within which the physical and chemical characteristics of the Callovo-Oxfordian layer are similar to those observed at the underground research laboratory. It covers an area of approximately 250 km^2.
Triggering event	Internal failure, or internal or external hazard, liable to be the direct or indirect cause of an incident or accident situation.
Underground facility (or installation)	All of the Cigeo structures, equipment and systems installed in the argillaceous Callovo-Oxfordian layer.
Usable part of the disposal cell	Part of the cell in which the disposal packages are placed.
Ventilation plant	Building containing all the equipment contributing to the operation, control and maintenance of the ventilation of a facility.
Vitrified waste	Radioactive waste conditioned in a glass matrix. Fission product solutions were the first waste to be vitrified.
Waste category	Category used to distinguish between management solutions on the basis of various criteria, including the radioactive half-life and the activity levels of the main radionuclides contained in the waste, as well as the physicochemical characteristics and origin of the waste. In the case of Cigeo, for example, this concerns high-level waste (HLW) and intermediate-level long-lived waste (ILW-LL).
Waste Package Characterisation File	Document describing the characteristics of a waste package family or group of waste package families. Waste Package Characterisation Files are drafted by waste producers on the basis of Andra specifications.

Terms	Definitions
Water table (of groundwater)	Groundwater that entirely fills the interstices in porous, permeable ground (aquifer) so that the water always connects the pores.
Wigner effect	Phenomenon in which energy is stored up by the graphite structures and then released, causing a sudden rise in temperature.
Zone of interest for detailed reconnaissance	Zone located in the transposition zone that: - includes a potential site for the ramp access in the neighbouring Meuse/Haute-Marne zone; - includes a potential site for the main access shafts in a wooded area; - avoids siting any installations under the built-up areas of villages. It covers an area of approximately 30 km2. A 3D seismic survey was carried out in 2010.

ACRONYMS

Acronym	Meaning
ADEME	French Environment and Energy Management Agency
AES	Altered evolution scenario
AIP	Activity important for protection
ALARA	As Low As Reasonably Achievable
APD	Detailed engineering design
APS	Basic engineering design
ASN	French Nuclear Safety Authority
ATEX	Explosive atmosphere
AVM	Marcoule vitrification facility. By extension, the term represents one of HLW glass varieties produced at the Marcoule plant in southern France.
BARPI	French Bureau for Analysis of Industrial Risks and Pollution
BLEVE	Boiling Liquid Expanding Vapour Explosion
CEA	French Alternative Energies and Atomic Energy Commission
CFI	Communications and security systems
CFI-CC	Communications, security and instrumentation and control systems
CFO	High- and low-voltage power supply
CLIS	Local Information and Oversight Committee

Acronym	Meaning
CMSI	Fire suppression control unit
CNDP	French National Public Debate Commission
CNE	National Assessment Board
COX	Callovo-Oxfordian
CP	Primary radioactive waste package
CS	Radioactive waste disposal package
CtS	Disposal container
DAC	Construction licence application
DNF	Last filtration level
DORec	Retrievability Options Report
DOS-AF	Safety Options Report-Post-closure Part
DOS-Exp	Safety Options Report – Operating Part
DPCI	Fire protection measure
DUP	Declaration of public utility
ECS	Stress test (the French abbreviation stands for “complementary safety assessment”)
EDEN	Thermonuclear device
EDF	Electricité de France
EDZ	Excavation Damaged Zone
EF	Functional unit or system

Acronym	Meaning
EIP	Elements Important for Protection
EIR	Excess individual risk
ET	Transport container
ET-H	Horizontal transport container
ET-V	Vertical transport container
FHA	Fire Hazard Analysis
GTC	Centralised technical management system
GTE	Power management system
HEPA	High-Efficiency Particulate Air filter
HLW	High-level waste. Divided into HLW0, HLW1 and HLW2 in increasing order of
HMI	Human-Machine Interface
HSR	High-availability Seamless Protocol
IAEA	International Atomic Energy Agency
ICPE	Environmentally regulated facility
ICRP	International Commission on Radiological Protection
ILW-LL	Intermediate-level long-lived waste
INB	Basic nuclear installation
IRSN	French Institute for Radiation Protection and Nuclear Safety
ITE	Private siding

Acronym	Meaning
LDCA	Derived airborne radionuclide concentration limit
LEL	Lower explosive limit
LPG	Liquefied Petroleum Gas
LSF	Surface-bottom connection
LV	Low voltage According to French standard NF C 18-510, low voltage (abbreviated LV) refers to voltage between i) 50 and 1,000 V AC or ii) between 120 et 1,500 V DC.
MCO	Through-life support
MLL	Limited lifting machine
MOx	Mixed oxide (mixture of uranium and plutonium oxides)
NACE	Statistical Classification of Economic Activities in the European Community
NEA	Nuclear Energy Agency
NES	Normal evolution scenario
OECD	Organisation for Economic Co-operation and Development
OPE	Perennial Observatory of the Environment
PCDL	Local management command centre
PCS	Security control centre
PDD	Project Development Plan
PDE	Master Plan for Operations
PIGD	Industrial waste management programme
PPE	Personal Protective Equipment

Acronym	Meaning
PPI	Off-site emergency plan
PRP	Parallel Redundancy Protocol
PUI	On-site emergency plan
QA	Quality Assurance
R&D	Research and Development
RFS	(French) Basic Safety Rule
RP	Radiation protection functional unit
SCC	Centralised control room
SCL	Local control room
SFC	Single failure criterion
SHOF	Social, human and organisational factors
SMPP	Maximum physically possible earthquake
SMS	Safe shutdown earthquake
SRI	Reference flood situation
SSI	Fire control system functional unit
UA	Clay unit
USC	Silty-carbonated unit
UT	Transition unit
UVCE	Unconfined Vapour Cloud Explosion

Acronym	Meaning
VDI	Voice Data Image
VN	Nuclear ventilation functional unit
VVE	Exhaust air extraction shaft
ZFC	Connected fracture zone
ZFD	Discrete fracture zone
ZIIS	Zones where surface facilities are located
ZIRA	Zone of interest for detailed reconnaissance
ZSL	Logistics Support Zone. There are two logistics support zones. An "operating" ZSL and a "construction" ZSL (respectively ZSL-E and ZSL-T)
ZT	Transposition zone