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DECREE
of …,

amending Decree No 375/2016 on selected items in the nuclear area (amendment to the Decree on selected items in the nuclear area)

Pursuant to § 236 of Act No 263/2016, the Atomic Act, for the implementation of § 18(5), § 24(7), § 25(2)(d), § 166(6)(7)(d), and § 169(4), the State Office for Nuclear Safety lays down the following:

Article I

Decree No 375/2016 on selected items in the nuclear area is amended as follows:

1. In the introductory sentence, the words '§ 166(6)(d)' are replaced with the words '§ 166(7)(d)'.
2. In the introductory part of § 1, the words 'import, export, transit, or' are inserted after the word 'its'.
3. In § 1(b), the words 'information about the type' are replaced with the words 'type and place'.
4. In § 1(c), the words 'import, export, transit, or' are inserted after the words 'execution of'.
5. In the introductory part of § 1(d), the words 'the applicant or' are inserted after the word 'about'.
6. In § 1(d)(1), the word 'surname' is inserted after the word 'names,' and the word 'surname' is replaced with the words 'date of birth'.
7. In § 1(d)(2), the words 'and identification number' are inserted after the word 'name'.
8. In § 1(e), the words 'or place of business' are inserted after the word 'domicile'.
9. In § 2, the words 'in the nuclear area, or for a notified activity that is the transfer of a selected item' are inserted after the word 'item'.
10. In the introductory part of § 3(1), the word 'import' is inserted after the words 'case of', the words 'or import or' are replaced with a comma, and the words 'or transfer' are inserted after the word 'transit'.
11. In § 3(1)(c), the words 'and other commercial' are replaced with the words 'or other' and the words 'proving the relationship between the supplier and the end user' are added at the end of the text.

12. In § 3(1)(d) the word ‘or’ is replaced with a comma and after the word ‘transit’ the words ‘or transfer’ are inserted.
13. In § 3(1)(d) the word ‘or’ is replaced with a comma and after the word ‘transited’ the words ‘or transferred’ are inserted.
14. In § 3(1)(f), the words ‘export, transit, or transfer’ are inserted after the word ‘import’.
15. In the introductory part of § 3(2), the word ‘import’ is inserted after the word ‘for’, the words ‘import or’ are deleted and the words ‘selected items in the nuclear area or the person declaring the transfer’ are inserted after the word ‘transit’.
16. In § 3(2)(a), the words ‘provided the deadline is not extended’ are inserted after the word ‘days’.
17. In § 5, the words ‘or transfer’ are inserted after the word ‘import’.
18. Annex 1 reads as follows:

‘Annex 1 to Decree No 375/2016

LIST OF SELECTED ITEMS IN THE NUCLEAR AREA SUBJECT TO IMPORT, EXPORT, TRANSIT, AND TRANSFER CONTROL REGIMENS SELECTED MATERIALS, EQUIPMENT, AND TECHNOLOGY IN THE NUCLEAR AREA

1. Nuclear reactors and equipment and components specially designed or prepared for them

Different types of nuclear reactors according to the moderator used (mainly graphite, heavy water, light water, no moderator), the neutron spectrum therein (e.g. thermal or fast), the type of coolant (e.g. water, liquid metal, molten salt, gas), and according to function or type (e.g. power reactors, research reactors, test reactors). All items in this point include all of the listed nuclear reactor types. This item does not include fusion reactors.

1.1 Complete nuclear reactors

Nuclear reactors capable of sustaining a controlled fission chain reaction.

A nuclear reactor includes items located within the reactor vessel or that are directly connected to it, equipment that manages core output, and components that contain the coolant of the reactor’s primary circuit, come into direct contact with it, or control its circulation.

1.2 Reactor vessels

Metal vessels or major shop-fabricated parts specially designed or prepared for location in the nuclear reactor core set out in Item 1.1, and nuclear reactor internals set out in Item 1.8.

Item 1.2 applies to reactor vessels regardless of rated pressure, and includes reactor pressure vessels and heavy water reactor vessels. The lid of the reactor vessel is included in Item 1.2 as a major shop-fabricated part of a reactor vessel.

1.3 Refuelling machines for nuclear reactors

Handling equipment specially designed or prepared for fuelling or removing fuel from a nuclear reactor set out in Item 1.1.

The equipment listed is capable of replacing nuclear fuel during operation or uses technically sophisticated elements for positioning or guidance that enable complex operations to be performed when replacing nuclear fuel during a nuclear reactor shutdown, when direct observation or access to the nuclear fuel is not usually possible.

1.4 Nuclear reactor control rods and related equipment

Rods specially designed or prepared for the control of the fission process in a nuclear reactor set out in Item 1.1, their load-bearing or suspensive structures, drive mechanisms, and rod guide tubes.

1.5 Nuclear reactor pressure tubes

Pipes specially designed or prepared to contain the fuel elements and cooling medium of the primary circuit in a nuclear reactor set out in Item 1.1.

Pressure tubes are part of fuel channels designed for operation under high pressure, which may exceed 5 MPa.

1.6 Nuclear fuel cladding

Tubes (or tube assemblies) made of zirconium or zirconium alloys, specially designed or prepared for use as fuel cladding in a nuclear reactor specified in item 1.1., or in quantities exceeding 10 kg.

Zirconium pressure tubes are classified under Item 1.5; tubes for heavy-water reactor vessels are classified under Item 1.8.

Tubes made of zirconium or zirconium alloys intended for use in nuclear reactors have a hafnium to zirconium weight ratio that is typically less than 1:500.

1.7 Pumps or circulation pumps for the primary circuit cooling medium

Pumps or circulation pumps specially designed or prepared for circulating the primary coolant of a nuclear reactor as specified in Item 1.1.

Specially designed or prepared pumps or circulation pumps include pumps for water-cooled reactors, circulating pumps for gas-cooled reactors, and electromagnetic or mechanical pumps for liquid metal-cooled nuclear reactors. These devices may include pumps with sophisticated sealing systems or multiple sealing systems to prevent leaks of primary circuit coolant, hermetic motor pumps, and centrifugal pumps.

1.8 Nuclear reactor internals

Nuclear reactor internals specially designed or prepared for use in a nuclear reactor specified in Item 1.1, including, for example, core support structures, fuel channels, heavy water reactor vessel tubes, thermal shielding, baffles, core grid plates and diffuser plates.

Nuclear reactor internals are defined as important structures within a reactor vessel that have one or more functions such as reinforcing and supporting the core, fuel arrangement, directing the flow of primary circuit coolant, providing radiation shielding for the reactor vessel and guiding in-core devices and instrumentation.

1.9 Heat exchangers

Heat exchangers are:

a. Steam generators specially designed or prepared for use in the primary or inserted cooling circuit of a nuclear reactor as specified in Item 1.1.

b. Other heat exchangers specially designed or prepared for use in the primary cooling circuit of a nuclear reactor as specified in Item 1.1.

Steam generators are specially designed or prepared to transfer heat generated in a nuclear reactor to feed water for steam production. In the case of a fast reactor that uses a coolant loop as an intermediate stage, the steam generator is in the inserted circuit.

In the case of a gas-cooled nuclear reactor, the heat exchanger can be used to transfer heat to a secondary gas loop that powers a gas turbine.

This item does not include heat exchangers for reactor support systems, such as emergency cooling systems or decay heat cooling systems.

1.10Neutron detectors

Specially designed or prepared neutron detectors for measuring the neutron flux in the core of a nuclear reactor as specified in Item 1.1.

This item includes detectors inside and outside the core that measure neutron flux levels over a wide range, typically from $10^{4,}$ neutrons per cm^{-2}/s or more. Detectors outside the core include devices outside the core of a nuclear reactor as specified in Item 1.1 that are located within the biological shielding.

1.11 External thermal shielding

External thermal shielding specially designed or prepared for use in a nuclear reactor as specified in Item 1.1 for heat loss reduction and containment protection

External thermal shielding is important structures placed over the reactor vessel that reduce heat loss and lower the temperature inside the containment vessel.

2. **Non-nuclear materials for nuclear reactors**

For the purposes of export control, the State Office for Nuclear Safety shall specify whether non-nuclear material meeting the parameters set out in items 2.1. and 2.2. is intended for use in a nuclear reactor. Non-nuclear materials meeting the parameters specified in items 2.1 and 2.2 that are not intended for use in a nuclear reactor are not included in this item.

2.1 Deuterium and heavy water

Deuterium, heavy water (deuterium oxide) and other compounds of deuterium in which the isotopic ratio of deuterium atoms to hydrogen atoms exceeds 1:5 000 for use in a nuclear reactor as specified in Item 1.1, in quantities exceeding 200 kg of deuterium for any one recipient country in the course of a single calendar year (1 January – 31 December).

2.2 Nuclear-grade graphite

Graphite with a purity of more than 5 ppm (parts per million) boron equivalent and with a density greater than 1.50 g/cm^3 for use in a nuclear reactor as specified in Item 1.1, in quantities greater than 1 kg.

The boron equivalent (BE) is determined experimentally or calculated as the sum of BE_z for impurities (other than BE_{carbon}, since carbon is not considered to be an impurity) including boron, where:

BE_z (ppm) = CF x concentration of element Z (in ppm);

CF is a conversion factor defined as follows: $\sigma_z A_B / \sigma_B A_Z$

where σ_B and σ_Z are the thermal neutron capture cross sections (in barrels) of the natural boron or element Z respectively; and A_B and A_Z are the atomic masses of the natural boron or element Z respectively.

3. **Plants for the reprocessing of irradiated fuel elements and equipment specially designed or prepared for this purpose**

Plants for the reprocessing of irradiated fuel elements or parts thereof using the Purex method, which are defined as equipment for chopping irradiated fuel elements, dissolving nuclear fuel, liquid extraction, and storage of process solutions. Plants may also include equipment for the thermal denitration of uranium nitrate, for the conversion of plutonium nitrate into oxide or metal, and for the treatment of liquid waste of fissile products into forms suitable for long-term storage or disposal.

The reprocessing of irradiated nuclear fuel separates plutonium and uranium from highly radioactive fission products and other transuranic elements. This separation can be achieved through various technological processes, the most commonly used method being Purex (this method involves dissolving irradiated nuclear fuel in nitric acid, followed by separation of uranium, plutonium and fission products by liquid-phase extraction using a mixture of tributyl phosphate in an organic solvent).

Nuclear fuel reprocessing plants contain equipment and components that normally come into direct contact with and directly control the process for spent fuel, nuclear material, and fissile products processing.

Items corresponding to the term 'equipment specially designed or prepared for reprocessing irradiated fuel elements' include:

3.1 Equipment for removing the cladding from irradiated nuclear fuel and machines for splitting irradiated fuel elements

Remote-controlled equipment specially designed or prepared for use in a plant for the reprocessing of irradiated fuel elements intended for the removal of nuclear fuel cladding and for the preparation of irradiated nuclear material in fuel cartridges, bundles, or rods for processing.

This refers to equipment for cutting, chopping, or shearing, or for otherwise breaking up the cladding of nuclear fuel in order to expose irradiated nuclear material for processing or to prepare fuel for processing.

3.2 Solvents

Dissolution vessels or solvents using mechanical equipment specially designed or prepared for use in plants for the reprocessing of irradiated nuclear fuel, intended for dissolving spent nuclear fuel, capable of withstanding hot, highly corrosive liquids, and that can be remotely loaded, controlled, and operated.

3.3 Liquid extractors and liquid extraction equipment

Specially designed or prepared extractors (such as packed and pulsed columns, mixing separators, or centrifugal contactors) for use in a plant for the reprocessing of irradiated nuclear fuel. Liquid extractors must be resistant to corrosion by nitric acid.

Liquid extractors are normally produced according to the most stringent standards (including special welding, inspections, quality assurance, and quality control techniques) of low carbon stainless steel, titanium, zirconium and other high-quality materials.

Liquid extractors hold a solution of irradiated nuclear fuel from solvent tanks and organic solutions for the separation of uranium, plutonium, and fission products. Liquid extraction equipment is designed as standard to meet stringent operating parameters, such as long service life without the need for maintenance or *adaptability for easy replacement, simplicity of operation and control, and flexibility with regard to variable operating conditions.*

3.4 Chemical storage vessels or reservoirs

Specially designed or prepared chemical holding or storage vessels intended for use in a plant for the reprocessing of irradiated nuclear fuel. They must be resistant to corrosion by nitric acid. They are typically made of low carbon stainless steel, titanium, zirconium, or other high-quality materials. They can be designed for remote operation and maintenance and may have the following parameters for the prevention of criticality:

1. Walls or internal structures with a boron equivalent value of at least 2%.
2. Maximum diameter of cylindrical vessels 175 mm.
3. A maximum width of 75 mm for either a slab or annular vessel.

Chemical holding or storage vessels are used for further processing of the three main streams resulting from the extraction process:

a) the pure uranium nitrate solution is concentrated by evaporation and, in a subsequent denitration process, converted into uranium oxide, which is reused in the nuclear fuel cycle;

b) the highly radioactive solution of fissile products is usually concentrated by evaporation and stored as a liquid concentrate. This concentrate may be subsequently evaporated and converted to a form suitable for storage or disposal, and

c) the pure plutonium nitrate solution is concentrated and stored until it is used for further process phases. In particular, containers for storing plutonium solutions or reservoirs designed for storing plutonium solutions are constructed in such a way as to prevent criticality problems caused by changes in the concentration and form of this solution.

3.5 Neutron measurement systems for process control purposes

Neutron measurement systems specially designed or prepared for integration and use with automated process control systems in plants for the reprocessing of irradiated fuel elements.

These systems include active and passive neutron measurement capabilities and discrimination capabilities for determining the quantity and composition of fissile materials. The system is composed of a neutron generator, a neutron detector, amplifiers, and signal processing electronics.

This item does not include neutron detection and measurement devices designed for warranty purposes for nuclear materials accountancy, or other applications that do not apply to integration or use with automatic process control systems in plants for the reprocessing of irradiated fuel elements.

4. Plants for the fabrication of nuclear reactor fuel elements and equipment specially designed or prepared for this purpose

Items corresponding to the concept of ‘equipment specially designed or prepared for the production of fuel elements’ include equipment that:

a) commonly comes into direct contact with nuclear material, directly processes or controls the production flow of nuclear material;

b) hermetically seals the nuclear material as part of cladding;

c) checks cladding coverage and the degree of hermeticity;

d) checks the final preparation of hermetically sealed nuclear fuel;

e) is used for the assembly of fuel elements for nuclear reactors.

Such equipment includes, for example:

1. fully automated inspection stands specially designed or prepared for checking the final dimensions and surface defects of pellets;

2. automatic welding machines specially designed or prepared for welding fuel cell end caps or rods;

3. automatic test and inspection benches specially designed or prepared for checking the integrity of finished fuel elements or rods;

4. systems specially designed or prepared for the production of nuclear fuel cladding.

Item 3 usually includes equipment for:

a) X-ray inspection of welds on end caps of elements or rods;

b) detection of helium leaks from pressurised elements or rods;

c) gamma-scanning of elements or rods to check they have been properly filled with fuel pellets.

5. Plants for the separation of isotopes of natural uranium, depleted uranium, or special fissionable material, and equipment other than analytical instruments specially designed or prepared for this purpose

Plants, equipment, and technology for uranium isotope separation, and plants, equipment and technology for the separation of isotopes of other elements, except for plants, equipment and technology for the separation of isotopes of other elements utilising an electromagnetic separation process.

Items that correspond to the term ‘equipment, other than analytical instruments, specially designed or prepared for the separation of isotopes of uranium’ include:

5.1 Gas centrifuges, assemblies, and components specially designed or prepared for use in gas centrifuges

A gas centrifuge for uranium enrichment is characterised by having within the rotor chamber a rotating disc baffle and a stationary tube arrangement for feeding tube and extracting UF_6 gas and featuring at least three separate channels, two of which are connected to scoops extending from the rotor axis towards the periphery of the rotor chamber. Components include critical parts that do not rotate and that, although specially designed, are not manufactured from special materials.

Materials with high strength to density ratio specified in items 5.1.1.a. to 5.1.1.e. used for the rotating parts of centrifuges mean:

a) maraging steels having an ultimate tensile strength equal to or greater than 1.95 GPa;

b) aluminium alloys having an ultimate tensile strength equal to or exceeding 0.46 GPa; and

c) filament materials suitable for use in composite structures with a specific modulus of 3.18×10^6m or greater and a specific ultimate tensile strength of 7.62×10^4 m or greater (the ‘specific modulus’ is Young’s Modulus in N/m^2 divided by the specific weight in N/m^3; the ‘specific ultimate tensile strength’ is the tensile strength in N/m^2 divided by the specific weight in N/m^3).

5.1.1. Rotating components

Rotating components are:

a. Complete rotor assemblies

Thin-walled cylinders or a number of interconnected thin-walled cylinders that are made from one or more of the materials with a high strength to density ratio. If the cylinders are interconnected, the connections are achieved by flexible bellows or rings described in Item 5.1.1.c. The rotor in its final form is equipped with an internal deflector and end caps described in Item 5.1.1.d and Item 5.1.1.e. The complete assembly may be delivered only partly assembled.

b. Rotor tubes

Specially designed or prepared thin-walled cylinders with a wall thickness of 12 mm or less, with a diameter of 75 mm to 650 mm made from a material with a high strength to density ratio.

c. Rings or bellows

Specially designed or prepared components designed to provide local support for a rotor tube or to connect a series of such tubes with each other. Bellows are a coiled short cylinder with a diameter of 75 mm and 650 mm with a maximum wall thickness of 3 mm, made of a material with a high strength to density ratio.

d. Bulkheads

Disc-shaped components of between 75 mm and 650 mm diameter specially designed or prepared for fitting inside a centrifuge rotor tube in order to separate the sampling chamber from the main separation chamber and, in some cases, to facilitate the circulation of UF_6 gas within the main separation chamber of the rotor tube. The bulkheads covered by this item are made from materials with a high strength to density ratio.

e. Top and bottom end caps

Disc-shaped components of between 75 mm and 650 mm diameter specially designed or prepared to close the ends of the rotor tube and contain UF_6 inside the rotor tube, and which in some cases also function as supports, hold or contain as an integral part an upper bearing (top cap) or carry rotating parts of the engine and a lower bearing (bottom cap). They are made from a material with a high strength to density ratio.

5.1.2. Static components

Static components are:

a. Magnetic suspension bearings

1. Specially designed or prepared bearing assemblies, consisting of annular magnets suspended within a housing containing a damping medium. The housing is made of material resistant to UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys with at least 60% nickel content, and fluoropolymers. The magnet is connected to a pole piece or to a second magnet fitted to the top cap specified in Item 5.1.1.e. and may have an annular shape, where the ratio between the outer and inner diameter is less than or equal to 1.6:1. The magnet may have an initial permeability of at least 0.15 H/m, a minimum remanence of 98.5% or greater, and an energy product of greater than 80 kJ/m^3.

In addition to the usual material properties, the deviation of the magnetic axis from the geometric axis is limited by very small tolerances (less than 0.1 mm) and the magnet material must be highly homogeneous.

2. Active magnetic bearings specially designed or prepared for use in gas centrifuges.

The bearings specified in Item a. usually have the following characteristics:

designed to maintain the centring of the rotor rotating at 600 Hz or more;

connection to a reliable power supply or uninterruptible power supply (UPS) for operation lasting more than one hour.

b. Bearings and dampers

Specially designed or prepared bearings comprising a pivot and cup mounted on a damper. The pivot is usually a hardened steel shaft with a hemisphere at one end and a means of attachment to the bottom cap described in Item 5.1.1.e at the other. A hydrodynamic bearing may be attached to the shaft. The cup is pellet-shaped with a hemispherical indentation in one surface. These components are often supplied separately from the damper.

c. Molecular pumps

Specially designed or prepared cylinders having internally machined or formed helical grooves and internally-machined openings. The usual dimensions are as follows: internal diameter 75 mm to 650 mm, wall thickness at least 10 mm, with a length to diameter ratio of 1:1 or greater. Grooves are typically rectangular in cross-section and 2 mm or more in depth.

d. Motor stators

Specially designed or prepared ring stators for high-speed multiphase AC hysteresis or reluctance motors for synchronous operation in a vacuum at a frequency of 600 Hz or greater and a power rating of at least 40 VA. Motor stators may consist of multiphase windings on a laminated low-loss metal core composed of thin layers, usually 2 mm thick or less.

e. Centrifuge housings

Components specially designed or prepared for the mounting of a gas centrifuge rotor tube assembly. The housing consists of a rigid cylinder with a wall thickness of up to 30 mm with precision machined ends to locate the bearings and with one or more mounting flanges. The machined ends are parallel to each other and perpendicular to the longitudinal axis of the cylinder with a deviation less than or equal to 0.05°. The housing may also be a honeycomb type structure to accommodate several rotor tubes.

f. Scoops

Specially designed or prepared tubes for the extraction of UF_6 gas from the rotor tube by Pitot tube action (with an aperture facing into the circumferential gas flow inside the rotor tube, for example, by bending the end of a radially placed tube), which can be fitted to the central gas extraction system.

5.2 Specially designed or prepared auxiliary systems, equipment, and components for use in gas centrifuge enrichment plants

Auxiliary systems, equipment, and components for use in gas centrifuge enrichment plants are systems necessary for transporting UF_6 to gas centrifuges, for connecting individual centrifuges together into centrifuge cascades for the purpose of gradually increasing enrichment, and for removing the product and UF_6 residues from the centrifuges, together with the equipment necessary to drive the centrifuges or to control the plant.

Material resistant to UF_6 is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60% nickel, and fluoropolymers.

5.2.1. Feed systems and product and tails removal systems

Specially designed or prepared process systems or equipment for enrichment plants made of or protected by materials resistant to corrosion by UF_6.

a. Feed autoclaves, ovens, or systems used for channelling UF_6 to the enrichment process.

b. Desublimators, cold traps, or pumps used to remove UF_6 from the enrichment process for subsequent transport after heating.

c. Solidification or liquefaction stations used to remove UF_6 from the enrichment process by compression and transformation of UF_6 to a liquid or solid.

d. Product or tails stations used for transferring UF_6 into containers.

5.2.2. Machine header piping systems

Specially designed or prepared piping systems and header systems (hereinafter "collectors") for handling UF_6 within centrifuge cascades. This piping network is normally of the triple header system type with each centrifuge connected to each of the headers. There is therefore a substantial amount of repetition in its form. These systems are constructed of materials resistant to corrosion by UF_6 and manufactured such that they meet very high vacuum and cleanliness standards.

5.2.3. Special shut-off and control valves

Specially designed or prepared valves include, for example, bellows-sealed valves, rapid-action flaps, or rapid-action valves.

a. Shut-off valves specially designed or prepared for feed, product, or tail UF6 gas flows for individual gas centrifuges.

b. Bellows-sealed valves, manual or automated, shut-off or control, made of or protected by materials resistant to corrosion by UF_6, with an inside diameter of 10 mm to 160 mm, specially designed or prepared for use in main or auxiliary systems of gas centrifuge enrichment plants.

5.2.4. Mass spectrometers for analysis of UF_6 and ion sources

Specially designed or prepared mass spectrometers capable of continuous sampling from UF gas streams$_6$, having all of the following characteristics:

1. The ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320.
2. Ion sources made of nickel, nickel and copper alloys containing at least 60% nickel by weight, or nickel and chrome alloys, or coated with these materials.
3. Ion sources with electron bombardment ionisation.
4. A collector system suitable for isotopic analysis.

5.2.5. Frequency changers

Frequency changers (also known as converters or inverters) specially designed or prepared to supply motor stators set out in Item 5.1.2.d or parts, components, and sub-assemblies of such frequency changers having both of the following characteristics:

1. Multiphase frequency output of 600 Hz or greater.
2. High stability with frequency control better than 0.2%.

5.3 Specially designed or prepared assemblies and components for use in gas diffusion enrichment

Items corresponding to 'specially designed or prepared assemblies and components for use in gaseous diffusion enrichment' include:

5.3.1. Gas diffusion barriers and barrier materials

Gaseous diffusion barriers and barrier materials are:

a. Specially designed or prepared thin porous filters with a pore size of 10 nm to 100 nm, a thickness of 5 mm or less, and if tubular a diameter of 25 mm or less, made of metal, polymeric or ceramic materials resistant to corrosion by UF_6, which for the purposes of this item means copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or alloys containing at least 60% nickel, and fluorinated hydrocarbon polymers.

b. Specially prepared compounds or powders for the production of these filters. Such compounds and powders include nickel or its alloys with a minimum of 60% nickel, aluminium oxide, or fully UF_6 resistant fluoropolymers with a purity of 99.9% or more, with a particle size of less than 10 µm and a high degree of uniformity of particle size, which are specially adapted for the manufacture of gas diffusion barriers.

5.3.2. Diffuser housings

Specially designed or prepared hermetically sealed containers with diffusion barriers made of or coated with material resistant to corrosion by UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60% nickel, and fluoropolymers.

5.3.3. Compressors and gas blowers

Specially designed or prepared compressors or gas blowers with minimum UF_6 suction volume of 1 m^3/min and discharge pressure up to 500 kPa, designed for long-term functionality in an environment containing UF_6, as well as individual assemblies of these compressors and gas blowers. These compressors and gas blowers have a compression ratio of 10:1 or less and are made of material resistant to corrosion by UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60% nickel, and fluoropolymers.

5.3.4. Rotary shaft seals

Specially designed or prepared vacuum seals that ensure the sealing of input and output flanges, used for sealing the shaft connecting the compressor rotor or gas blowers with the drive motor and providing a reliable seal for the inner chamber of a compressor or gas blower that is filled with UF_6. Such seals are normally designed with a buffer gas ingress rate of less than 1000 cm^3/min.

5.3.5. Heat exchangers for cooling UF_6

Specially designed or prepared heat exchangers made of or coated with materials resistant to corrosion by UF_6, which for this item ire defined as copper, copper alloys, stainless steel, aluminium, aluminium alloys, aluminium oxide, nickel or its alloys containing at least 60% nickel, and fluoropolymers. These are designed for a rate of pressure change due to leaks of less than 10 Pa per hour at a pressure difference of 100 kPa.

5.4 Specially designed or prepared auxiliary systems, equipment and components for use in gaseous diffusion enrichment plants

Auxiliary systems, equipment, and components for use in gas diffusion enrichment plants are plant systems for feeding UF_6 into gas diffusion assemblies, for connecting individual assemblies into cascades (stages) to progressively increase enrichment, and for removing product and UF_6 residues from the diffusion cascades. The items described below come into direct contact with UF_6 process gas or directly regulate flow in the cascade. They meet very high vacuum and cleanliness standards. Measuring, regulating, and control systems ensure strict and continuous maintenance of vacuum in all process systems, automatic emergency protection, and precise automatic regulation of gas flow. All surfaces that come into contact with the process gas are wholly made of or coated with UF_6-resistant materials.

5.4.1. Feed systems and systems for removal of products and tails

Specially designed or prepared technological systems or equipment for enrichment plants made of material resistant to corrosion by UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60 % nickel, and fluoropolymers.

a. Feed autoclaves, ovens, or systems used for passing UF_6 to the enrichment process.

b. Desublimators, cold traps, or pumps used to remove UF_6 from the enrichment process for subsequent transport after heating.

c. Solidification or liquefaction stations used to remove UF_6 from the enrichment process by compression and transformation of UF_6 to a liquid or solid.

d. Product or tails stations used for transferring UF_6 into containers.

5.4.2. Header piping systems

Specially designed or prepared piping systems and header systems for transporting UF_6 within the gaseous diffusion cascades.

This piping network is normally is usually designed as a double header system, with each cell connected to each of the headers.

5.4.3. Vacuum systems

Vacuum systems are:

a. Specially designed or prepared large vacuum manifolds, vacuum headers, and vacuum pumps having a suction capacity of 5 m^3/min or more.

b. Specially designed vacuum pumps for use in an environment containing UF_6, made of or coated with material resistant to corrosion by UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium alloys, aluminium oxide, nickel or its alloys containing at least 60% nickel, and fluoropolymers. These pumps may be designed as rotary or volumetric pumps. They may have fluorinated hydrocarbon polymer plugs and seals and may use special working fluids.

5.4.4. Special shut-off and control valves

Specially designed or prepared bellows-sealed valves, manual or automatic, shut-off or control, for installation in main and auxiliary systems of gas diffusion enrichment plants, made of or coated with material resistant to corrosion by UF_6, which for this item is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60% nickel, and fluoropolymers.

5.4.5. Mass spectrometers for analysis of UF_6 and ion sources

Specially designed or prepared mass spectrometers capable of continuous sampling from UF_6 gas streams, having all of the following characteristics:

1. The ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320.
2. Ion sources made of nickel, nickel and copper alloys containing at least 60% nickel by weight, or nickel and chrome alloys, or coated with these materials.
3. Ion sources with electron bombardment ionisation.
4. Have a collector system suitable for isotopic analysis.

5.5 Specially designed or prepared systems, equipment and components for use in aerodynamic enrichment plants

Specially designed or prepared systems, equipment and components for use in aerodynamic enrichment plants are items that come into direct contact with UF_6 process gas or directly regulate flow inside the cascade.

All surfaces that come into contact with the process gas are wholly made of or coated with UF_6-resistant materials. For the purposes of section items related to enrichment based on the aerodynamic process, materials resistant to corrosion by UF_6 are defined as copper, copper alloys, stainless steel, aluminium, aluminium alloys, aluminium oxide, nickel, or alloys containing at least 60% nickel by weight, and fluoropolymers.

5.5.1. Separation nozzles

Specially designed or prepared separation nozzles or assemblies thereof. Separation nozzles consist of slit-shaped, curved channels with a radius of curvature less than 1 mm, made of materials resistant to corrosion by UF_6, and have a blade inside that separates the gas flowing through the nozzle into two streams.

5.5.2. Vortex tubes

Specially designed or prepared vortex tubes and assemblies thereof. Vortex tubes are cylindrical or conical, made of or protected by materials resistant to corrosion by UF_6 and with one or more tangential inlets. The tubes may be fitted with nozzles at one or both ends.

The process gas enters the vortex tube tangentially at one end or through the vortex blades or in numerous tangential positions along the edge of the tube.

5.5.3. Compressors and gas blowers

Specially designed or prepared compressors or gas blowers made of or protected by materials resistant to corrosion by UF_6/carrier gas (hydrogen or helium) mixture.

5.5.4. Rotary shaft seals

Specially designed or prepared rotary shaft seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor or the gas blower rotor with the driver motor to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor or gas blower which is filled with a UF_6/carrier gas mixture.

5.5.5. Heat exchangers for gas cooling

Specially designed or prepared heat exchangers made of or protected by materials resistant to corrosion by UF_6.

5.5.6. Separation element housings

Specially designed or prepared separation element housings, made of or protected by materials resistant to corrosion by UF_6, designed for installation in vortex tubes or separation nozzles.

5.5.7. Feed systems and systems for removal of products and tails

Specially designed or prepared process systems or equipment for enrichment plants made of or protected by materials resistant to corrosion by UF_6, including:

a. Feed autoclaves, ovens, or systems used for passing UF6 to the enrichment process.

b. Desublimators or cold traps used to remove UF6 from the enrichment process for subsequent transport after heating.

c. Solidification or liquefaction stations used to remove UF6 from the enrichment process by compression and transformation of UF6 to a liquid or solid.

d. Product or tails stations used for transferring UF_6 into containers.

5.5.8. Header piping systems

Specially designed or prepared header piping systems, made of or protected by materials resistant to corrosion by UF_6, for handling UF_6 within the aerodynamic cascades. The piping network is normally of a double header design with each stage or group of stages connected to each of the headers.

5.5.9. Vacuum systems and pumps

Vacuum systems and vacuum pumps include:

a. Specially designed or prepared vacuum systems consisting of vacuum manifolds, vacuum headers, and vacuum pumps, and designed for service in UF6-bearing atmospheres.

b. Vacuum pumps specially designed or prepared for service in UF_6-bearing atmospheres and made of or protected by materials resistant to corrosion by UF_6. These pumps may use fluorocarbon seals and special working fluids.

5.5.10. Special shut-off and control valves

Specially designed or prepared bellows-sealed valves, manually or automatically operated, shut-off or control valves, made of or protected by materials resistant to corrosion by UF_6, with a diameter of at least 40 mm, that are installed on the main and auxiliary systems of aerodynamic enrichment plants.

5.5.11. Mass spectrometers for analysis of UF_6 and ion sources

Specially designed or prepared mass spectrometers capable of continuous sampling from streams of gaseous UF_6, having all of the following characteristics:

1. The ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320.
2. Ion sources made of nickel, nickel and copper alloys containing at least 60% nickel by weight, or nickel and chrome alloys, or protected by these materials.
3. Ion sources with electron bombardment ionisation.
4. Have a collector system suitable for isotopic analysis.

5.5.12. Systems for separation of UF_6 from carrier gas

Specially designed or prepared process systems for separating UF_6 from carrier gas (hydrogen or helium).

These systems are designed to reduce the UF_6 content in the carrier gas to 1 ppm or less and may contain the following equipment:

a) cryogenic heat exchangers or cryoseparators capable of temperatures of 153 K (-120°C) or less;

b) cryogenic refrigeration units reaching temperatures of 153 K (-120°C) or lower;

c) separation nozzles or vortex tubes for the separation of UF_6 from carrier gas; or *d) UF_6 cold traps capable of freezing out UF_6.*

5.6 Specially designed or prepared systems, equipment and components for use in chemical exchange or ion exchange enrichment plants

5.6.1. Liquid-liquid exchange columns (chemical exchange)

Counter-current liquid-liquid exchange columns having mechanical power input, specially designed or prepared for uranium enrichment using the chemical exchange process. For corrosion resistance to concentrated HCl solutions, these columns and their internals are usually made of or protected by glass or suitable plastic materials (such as fluorocarbon polymers). In the standard version, the filter reservoir is designed for a maximum projected running time of 30 seconds.

5.6.2. Liquid-liquid centrifugal extractors (chemical exchange)

Specially designed or prepared liquid centrifugal extractors for uranium enrichment using the chemical exchange process. They use rotation to achieve dispersion of the organic and aqueous streams and then centrifugal force to separate the phases. For corrosion resistance to HCl, these extractors are made of or protected by suitable plastic materials (such as fluorocarbon polymers) or glass. In the standard version, the filter reservoir is designed for a maximum projected running time of 30 seconds.

5.6.3. Uranium reduction systems and equipment (chemical exchange)

Uranium reduction systems and equipment are:

a. Specially designed or prepared electrochemical reduction cells to reduce uranium from one valence state to another for uranium enrichment using the chemical exchange process. Cell materials that come into contact with process solutions are corrosion resistant to concentrated HCl solutions.

The cell cathode compartment must be designed to prevent re-oxidation of uranium to its higher valence state. To keep the uranium in the cathodic compartment, cells may have impervious diaphragm membranes constructed of special cation exchange material. The cathode consists of a suitable solid conductor such as graphite.

b. Specially designed or prepared systems at the cascade outlet for the extraction of U^{+4} from the organic stream, regulation of acid concentration and power supply to electrochemical reduction cells.

Those parts of the system that come into contact with process streams are made of or protected by suitable materials such as glass, fluorocarbon polymers, polyphenyl sulphate, polyether sulphone, and resin-impregnated graphite.

5.6.4. Feed solution preparation systems (chemical exchange)

Specially designed or prepared systems for the production of high-purity UCl_3 feed solutions for uranium isotope separation plants based on chemical exchange.

These systems contain equipment for purification using solvents or cleaning using ion exchange through electrolytic reduction of U^{+6} or U^{+4} to U^{+3}. These systems produce UCl_3 that contain just a few ppm metal impurities, especially chrome, iron, vanadium, molybdenum, and other bivalent or multivalent cations. The parts of the system processing high-purity U^{+3} are made of glass, fluorinated hydrocarbon polymers, polyphenyl sulphate, polyethersulfone or resin-impregnated graphite.

5.6.5. Uranium oxidation systems (chemical exchange)

Specially designed or prepared systems for oxidation of U^{+3} to U^{+4} for return to the uranium isotope separation cascade in the chemical exchange enrichment process.

These systems may include the following equipment:

a) equipment for mixing chlorine and oxygen with liquid flowing out of the isotope separation equipment and for extracting the resulting U^{+4} to the depleted organic stream recirculated from the outlet end of the cascade;

b) equipment that separates water from HCl so that they can be returned to the process at appropriate points.

5.6.6. Fast-reacting ion exchange resins/adsorbents (ion exchange)

Specially designed or prepared resin-based or adsorbent-based ion exchangers with fast exchange kinetics for uranium enrichment based on the ion exchange process, including porous macro--cross-linked resins and/or thin-layer structured carriers in which the active groups participating in the chemical exchange are concentrated only on the surface of an inactive porous carrier or on composite carriers of suitable forms, including particles or fibres. These ion exchange resins/adsorbents have diameters of 0.2 mm or less and must be chemically resistant to concentrated HCl solutions as well as physically strong enough so as not to degrade in the exchange columns. The resins/adsorbents are specially designed to achieve very fast uranium isotope exchange kinetics (exchange rate half-time of less than 10 seconds) and are capable of operating at temperatures between 373 K (100°C) and 473 K (200°C).

5.6.7. Ion exchange columns (ion exchange)

Cylindrical columns greater than 1000 mm in diameter for containing and supporting packed beds of ion exchange resin/adsorbent, specially designed or prepared for uranium enrichment using the ion exchange process. These columns are made of or protected by materials (such as titanium or fluorocarbon plastics) resistant to corrosion by concentrated HCl solutions and are capable of operating at temperatures between 373 K (100°C) and 473 K (200°C) and pressures above 0.7 MPa.

5.6.8. Reflux systems for ion exchange (ion exchange)

Reflux systems for ion exchange are:

a. Specially designed or prepared chemical or electrochemical reduction systems for regeneration of chemical reducing agents used in ion exchange uranium enrichment cascades.

In the ion exchange enrichment process, Ti^{+3}, for example, can be used as a reducing cation. In this case, the reduction system would reduce Ti^{+4} and thus generate Ti^{+3}.

b. Specially designed or prepared chemical or electrochemical oxidation systems for regeneration of chemical oxidising agents used in ion exchange uranium enrichment cascades.

In this process, Fe^{+3}, for example, can be used as an oxidant. In this case, the oxidation system would oxidise Fe^{+2} and thus generate Fe^{+3}.

5.7 Specially designed or prepared systems, equipment and components for use in laser-based enrichment plants

Current laser-based enrichment systems fall into a category where the process medium is atomic uranium vapour, or into a category where the process medium is uranium compound vapour (in some cases mixed with other gas or gases).

The common nomenclature for these processes includes:

first category – laser separation of atomic uranium vapour;

second category – molecular laser separation, including chemical reaction induced by selective laser activation.

Systems, equipment and components for use in laser enrichment plants include:

a) equipment for supplying vapour of metallic uranium (for selective photo-ionisation) or vapour of uranium compounds (for selective photo-dissociation or selective excitation or activation);

b) equipment for collecting enriched and depleted metallic uranium as a product and first category residues, and equipment for collecting enriched and depleted uranium compounds as a product and second category residues;

c) laser systems for the selective excitation of atoms or molecules containing ^{235}U*;*

d) equipment for preparing the incoming material and converting the product. The complexity of the spectroscopy of uranium atoms and compounds may require incorporation of any of a number of available laser and laser optic technologies.

Many of the items listed in this section 5.7. come into direct contact with uranium metal vapour or liquid or with process gas consisting of UF_6 *or a mixture of* UF_6 *and other gases. All surfaces that come into direct contact with uranium or* UF_6 *are either made entirely of corrosion-resistant materials or are protected by such materials. For the purposes of the section on items for use in laser-based enrichment plants, materials resistant to corrosion by gaseous or liquid metallic uranium or uranium alloys include, for example, yttria-coated graphite and tantalum. For this item, material resistant to* UF_6 *is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60% nickel, and fluoropolymers.*

5.7.1. Uranium evaporation systems (atomic uranium vapour separation based methods)

Specially designed or prepared evaporation systems for laser enrichment of uranium metal.

These systems may contain high-power electron beam guns with a delivered power on the target of at least 1 kW, which is sufficient for generating uranium metal vapour required for laser enrichment.

5.7.2. Systems and components for handling liquid or gaseous uranium metal (atomic uranium vapour separation methods)

Specially designed or prepared systems or components used in handling molten uranium, molten uranium alloys, or uranium metal vapours as part of laser enrichment.

Systems and components for handling liquid uranium may contain crucibles and equipment for cooling these crucibles. The crucibles and other parts of this system that come into contact with molten uranium, molten uranium alloys, or metal uranium vapours are made of or protected by materials of suitable corrosion and heat resistance. Suitable materials include graphite coated with yttrium, graphite coated with oxides of other rare earth metals, or mixtures thereof.

5.7.3. Uranium metal product and tails header assemblies (atomic uranium vapour separation methods

Specially designed or prepared product and tails header assemblies for uranium metal in liquid or solid form.

The components of these assemblies are made of or protected by materials resistant to the heat and corrosion of uranium metal vapour or molten uranium (for example yttrium-coated graphite or tantalum). They may include pipes, valves, fittings, grooves, bushings, heat exchangers, and collector plates for magnetic, electrostatic, or other separation methods.

5.7.4. Separation module housings (atomic uranium vapour separation methods)

Specially designed or prepared cylindrical or rectangular vessels for containing the uranium metal vapour source, the electron beam gun, and headers for the product (enriched uranium) and tails (depleted uranium).

These housings have ports for electrical and water feed-throughs, laser beam windows, vacuum pump connections, and instrumentation diagnostics and monitoring. They are equipped with opening and closure provisions to allow refurbishment of internal components.

5.7.5. Supersonic expansion nozzles (molecular laser separation methods)

Specially designed or prepared supersonic expansion nozzles, resistant to corrosion by UF_6 and intended for cooling mixtures of UF_6 and carrier gas to 150 K (-123°C) or less.

5.7.6. Product or tails collectors (molecular laser separation methods)

Specially designed or prepared components or equipment for collection of uranium product or uranium tails after laser irradiation.

In one possible molecular laser separation, product collectors are used to collect enriched uranium pentafluoride (UF_5) in solid form. The product collectors may include a filter, impactor or cyclone-type collector or a combination thereof and must be corrosion resistant to the UF_5 or UF_6 environment.

5.7.7. Compressors for carrier gas and UF_6 (molecular laser separation methods)

Specially designed or prepared compressors for UF_6/carrier gas mixtures, designed for long-term operation in a UF_6 environment. The components of these compressors that come into contact with process gas are made of or protected by materials resistant to corrosion by UF_6.

5.7.8. Shaft seals (molecular laser separation methods)

Specially designed or prepared vacuum seals, with seal feed and seal exhaust connections. They are used for sealing the shaft connecting the compressor rotor with the driver motor to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor which is filled with a UF_6 /carrier gas mixture.

5.7.9. Fluorination systems (molecular laser separation methods)

Specially designed or prepared systems for fluorinating UF_5 (solid) to UF_6 (gas).

5.7.10. Mass spectrometers for analysis of UF_6 and ion sources (molecular laser separation methods)

Specially designed or prepared mass spectrometers capable of continuous sampling from UF_6 gas streams, having all of the following characteristics:

1. The ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320.
2. Ion sources made of nickel, nickel and copper alloys containing at least 60% nickel by weight, or nickel and chrome alloys, or protected by these materials.
3. Ion sources with electron bombardment ionisation.
4. Have a collector system suitable for isotopic analysis.

5.7.11. Feed systems and systems for removal of products and tails (molecular laser separation methods)

Specially designed or prepared process systems or equipment for enrichment plants made of or protected by materials resistant to corrosion by UF_6, such as:

a. Feed autoclaves, ovens, or systems used for passing UF_6 to the enrichment process.

b. Desublimators (or cold traps) used to remove UF_6 from the enrichment process for subsequent transfer upon heating.

c. Solidification or liquefaction stations used to remove UF_6 from the enrichment process by compression and transformation of UF_6 to a liquid or solid.

d. Product or tails stations used for transferring UF_6 into containers.

5.7.12. Systems for separation of UF_6 from carrier gas (molecular laser separation methods)

Specially designed or prepared process systems for separating UF_6 from carrier gas.

These systems may include devices such as:

a) cryogenic heat exchangers or cryoseparators capable of temperatures of 153 K (-120°C) or less;

b) cryogenic refrigeration units reaching temperatures of 153 K (-120°C) or lower;

c) UF_6 cold traps capable of freezing out UF_6.

5.7.13. Laser systems

Lasers or laser systems specially designed or prepared for the separation of uranium isotopes.

A laser system typically includes both optical and electronic components for controlling the laser beam (or beams) and transmitting it to the isotope separation chamber. The laser system for atomic vapour based methods usually consists of tunable dye lasers pumped by another type of laser; for example, copper vapour lasers or certain solid-state lasers. The laser system for molecular based methods may consist of CO2 lasers or excimer lasers and a multi-pass optical cell. Lasers or laser systems for both methods require spectrum frequency stabilisation for operation over extended periods of time.

5.8 Specially designed or prepared systems, equipment, and components for use in plasma separation enrichment plants

In the plasma separation process, a plasma of uranium ions passes through an electric field tuned to the ^{235}U ion resonance frequency so that they preferentially absorb energy and increase the diameter of their orbits. Ions with a large diameter path are captured to create a product enriched with ^{235}U. The plasma created by the ionisation of uranium vapour is enclosed in a vacuum chamber with a strong magnetic field formed by a superconducting magnet. The main technological *systems of this process include the uranium plasma generation system, the separator module with superconducting magnet, and metal removal systems for the collection of product and tails.*

5.8.1. Microwave power sources and antennae

Specially designed or prepared microwave power sources and antennae for producing or accelerating ions that have frequencies greater than 30 GHz and capable of handling more than 50 kW mean power output for ion production.

5.8.2. Ion excitation coils

Specially designed or prepared radio frequency ion excitation coils for frequencies of more than 100 kHz and capable of handling more than 40 kW mean power.

5.8.3. Uranium plasma generation systems

Specially designed or prepared systems for creation of uranium plasma for use in plasma separation enrichment plants.

5.8.4. *(This code is reserved for future use)*

5.8.5. Uranium metal product and tails collector assemblies

Specially designed or prepared product and tails collector assemblies for uranium metal in solid form. These assemblies are made of or protected by refractory materials resistant to corrosion by uranium metal vapour, such as yttria-coated graphite or tantalum.

5.8.6. Separator module housings

Specially designed or prepared cylindrical vessels for use in plasma separation enrichment plants for containing the uranium plasma source, radio-frequency drive coil, and the product and tails collectors.

These housings have ports for electrical feed-throughs, diffusion pump connections, and instrumentation diagnostics and monitoring. They have provisions for opening and closure to allow for refurbishment of internal components and are constructed of a suitable non-magnetic material such as stainless steel.

5.9 Specially designed or prepared systems, equipment and components for use in electromagnetic enrichment plants

5.9.1. Electromagnetic isotope separators

Specially designed or prepared for the separation of uranium isotopes, and equipment and components for this purpose:

a. Ion sources

Specially designed or prepared single or multiple uranium ion sources consisting of a vapour source, ionizer, and beam accelerator, constructed of materials such as graphite, stainless steel, or copper, and capable of providing a total ion beam current of 50 mA or greater;

b. Ion collectors

Collector plates consisting of two or more slits and pockets especially designed or prepared for collection of enriched and depleted uranium ion beams and constructed of materials such as graphite or stainless steel;

c. Vacuum housings

Specially designed or prepared vacuum housings for electromagnetic uranium separators, made of suitable non-magnetic materials such as stainless steel and designed for operation at pressures of 0.1 Pa or lower.

The housings are specially designed to contain the ion sources, collector plates and *water-cooled liners. They have provision for diffusion pump connections and opening and closure for removal and re-installation of these components.*

d. Magnet pole pieces

Specially designed or prepared magnet pole pieces having a diameter greater than 2 m, used to maintain a constant magnetic field within an electromagnetic isotope separator and to transfer the magnetic field between adjoining separators.

5.9.2. High-voltage power supplies

Specially designed or prepared high-voltage power supplies for ion sources, having all of the following characteristics:

1. Capable of continuous operation.
2. Input voltage of 20 000 V or greater.
3. Output current 1 A or greater.
4. Voltage regulation better than 0.01% over 8 hours.

5.9.3. Magnet power supplies

Specially designed or prepared high-power, direct current magnet power supplies having all of the following characteristics:

1. The ability to continuously deliver output current of 500 A or greater at a voltage of 100 V or more.
2. Current or voltage regulation better than 0.01% over 8 hours.

6. **Plants for the manufacture and reworking of concentrations of heavy water, deuterium and its compounds and devices specially designed or prepared for this purpose**

Equipment that is especially designed or prepared for the production of heavy water utilising either the water-hydrogen sulphide exchange process or the ammonia-hydrogen exchange process, including parts of equipment that are not specially designed or prepared for the production of heavy water, but are installed in systems that are specially designed or prepared for this production. Items corresponding to the term 'equipment specially designed or prepared for the production of heavy water' include:

6.1 Water-hydrogen sulphide exchange towers

Exchange towers with diameters of 1.5 m or greater and capable of operating at pressures greater than or equal to 2 MPa especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process.

6.2 Blowers and compressors

Single stage, low head (i.e. 0.2 MPa) centrifugal blowers or compressors specially designed or prepared for circulation of gas containing more than 70% H_2S used in heavy water production utilising the water-hydrogen sulphide exchange process. These blowers or compressors have a throughput capacity greater than or equal to 5 m^3/s while operating at pressures greater than or equal to 1.8 MPa and have seals designed for wet H_2S service.

6.3 Ammonia-hydrogen exchange columns

Exchange towers with a minimum height of 35 m and diameter of 1.5 m or more capable of operating at pressures greater than 15 MPa and specially designed or prepared for heavy water production utilising the ammonia-hydrogen exchange process. These towers also have at least one flanged, axial opening of the same diameter as the cylindrical part through which the chamber internals can be inserted or withdrawn.

6.4 Tower internals and stage pumps

Tower internals and stage pumps specially designed or prepared for towers for heavy water production utilising the ammonia-hydrogen exchange process. Tower internals include specially designed stage contactors that promote intimate gas/liquid contact. Staged pumps include specially designed submersible pumps designed for circulation of liquid ammonia in the contact stage inside the towers.

6.5 Ammonia crackers

Ammonia crackers with operating pressures greater than or equal to 3 MPa specially designed or prepared for heavy water production utilising the ammonia hydrogen exchange process.

6.6 *(This code is reserved for future use)*

6.7 Catalytic burners

Catalytic burners for the conversion of enriched deuterium gas into heavy water specially designed or prepared for heavy water production utilising the ammonia hydrogen exchange process.

6.8 Complete heavy water upgrade systems or columns for this purpose

Complete heavy water upgrade systems or columns with a diameter of 0.1 m or greater specially designed or prepared for achieving deuterium concentration required for use in a nuclear reactor.

6.9 Ammonia synthesis converters or synthesis units

Ammonia synthesis converters or synthesis units specially designed or prepared for heavy water production utilising the ammonia hydrogen exchange process.

These converters or units take synthesis gas (nitrogen and hydrogen) from an ammonia/hydrogen high-pressure exchange column (or columns), and the synthesized ammonia is returned to the given column (or columns).

6.10Columns filled with catalysts for hydrogen isotope exchange

Complete columns specially designed or prepared for hydrogen isotope exchange with all of the following characteristics:

1. Filled with random or structured platinum catalysts resistant to moisture.
2. Made of carbon steel or stainless steel.
3. Capable of operating at pressures in the range of 0.1 to 4 MPa.
4. Ability to operate at temperatures ranging from 293 K (20°C) to 473 K (200°C).

7. Plants for the conversion of uranium and plutonium for use in the manufacture of fuel elements and the separation of uranium isotopes and equipment specially designed or prepared for this purpose

7.1 Plants for the conversion of uranium and equipment specially designed or prepared for this purpose

Plants for the conversion of uranium, in which one or more uranium transformations can be performed from one of its chemical forms to another, including: conversion of uranium ore concentrates to UO_3, , conversion of UO_3 to UO_2, conversion of uranium oxides to UF_4, UF_6, or UCl_4 conversion of UF_4 to UF_6, conversion of UF_6 to UF_4, conversion of UF_4 to uranium metal, and conversion of uranium fluorides to UO_2.

In all uranium conversion processes, components and equipment which are not specially designed or prepared for uranium conversion may be assembled in systems which are already specially designed or prepared for uranium conversion.

7.1.1. Specially designed or prepared systems for the conversion of uranium ore concentrates to UO_3

Uranium ore concentrates may be converted to UO_3 by dissolving the ore in HNO_3 and extracting pure $UO_2(NO_3)_2$ using a solvent such as $C_{12}H_{27}O_4P$. $UO_2(NO_3)_2$ is then converted to UO_3, either by concentration and denitrification or by neutralisation with gaseous NH_3 to form $(NH_4)_2U_2O_7$ followed by filtration, drying and calcination.

7.1.2. Specially designed or prepared systems for the conversion of UO_3 to UF_6

Conversion of UO_3 to UF_6 can take place directly, through fluorination with a source of F_2 or CIF_3.

7.1.3. Specially designed or prepared systems for the conversion of UO_3 to UO_2

The conversion of UO_3 to UO_2 can be achieved by reducing UO_3 with cracked NH_3 gas or hydrogen.

7.1.4. Specially designed or prepared systems for the conversion of UO_2 to UF_4

Conversion of UO_2 to UF_4 may be performed by reaction of UO_2 with gaseous HF at 573-773 K
(300 - 500°C).

7.1.5. Specially designed or prepared systems for the conversion of UF_4 to UF_6

Conversion of UF_4 to UF_6 is performed by exothermic reaction with fluorine in a tower reactor. UF_6 is concentrated from hot effluent gases when passing through a cold trap cooled to 263 K (-10°C). This process requires a source of gaseous F_2.

7.1.6. Specially designed or prepared systems for the conversion of UF_4 to uranium metal

The conversion of UF_4 to uranium metal is carried out by reduction with magnesium (large batches) or calcium (small batches). The reaction is carried out at temperatures above the melting point of uranium (1403 K - 1130°C).

7.1.7. Specially designed or prepared systems for the conversion of UF_6 to UO_2

The conversion of UF_6 to UO_2 can be carried out by one of three processes:
reduction of UF_6 and hydrolysis to UO_2 using hydrogen and steam;
hydrolysis of UF_6 by dissolution in water and precipitation $(NH_4)_2U_2O_7$ by adding NH_3, when $(NH_4)_2U_2O_7$ is subsequently reduced to UO_2 with hydrogen at 1093 K (820°C);
reaction of gaseous UF_6, CO_2 and NH_3 in water with precipitation of $UO_2(CO_3)_3(NH_4)_4$. The reaction of $UO_2(CO_3)_3(NH_4)_4$ with steam and hydrogen at 773 – 873 K (500 – 600°C) yields UO_2.

7.1.8. Specially designed or prepared systems for the conversion of UF_6 to UF_4

Conversion of UF_6 to UF_4 is performed by reduction with hydrogen.

7.1.9. Specially designed or prepared systems for the conversion of UO_2 to UCl_4

Conversion of UO_2 to UCl_4 can be performed by one of two processes.
· by reaction of UO_2 with CCl_4 at approximately 673 K (400°C);
· reaction of UO_2 at a temperature of approximately 973 K (700°C) in the presence of soot (CAS 1333-86-4), CO and chlorine, with the resulting product being UCl_4.

7.2 Plants for the conversion of plutonium and equipment specially designed or prepared for this purpose

Plants and systems for the conversion of plutonium from one chemical species to another, such as:

conversion of PuN to PuO_2;

conversion of PuO_2 *to* PuF_4;

conversion of PuF_4 *to plutonium metal.*

In all plutonium conversion processes, components and equipment that are not individually specially designed or prepared for plutonium conversion may be assembled into systems that are specially designed or prepared for plutonium conversion.

7.2.1. Specially designed or prepared systems for the conversion of plutonium nitrate to oxide

7.2.2. Specially designed or prepared systems for plutonium metal production

This process typically involves fluorinating PuO_2*, usually with highly corrosive HF, to produce plutonium fluoride, from which metallic plutonium is obtained by subsequent reduction using high-purity metallic calcium. The process systems are particularly adapted so as to avoid criticality and radiation effects and to minimise toxicity hazards. Other processes include the fluorination of plutonium oxalate or plutonium peroxide followed by a reduction to metal.*

8. Packaging for irradiated nuclear fuel and hot cells

8.1 Packaging for irradiated nuclear fuel

Packaging for the transportation or storage of irradiated nuclear fuel that provides chemical, thermal, and ionizing radiation protection and removal of decay heat during handling, transportation, and storage.

8.2 Hot cells

Hot cells or interconnected hot cells with a total volume of at least 6 m^3 and shielding corresponding to the equivalent of 0.5 m or more concrete, with a density of 3.2 g/cm^3 or higher, with facilities for remote control.

9. Technology

Technology directly related to any item specified in points 1 to 8, except for information in the public domain or basic scientific research.

10. Software

Software directly related to any item specified in points 1 to 8, except for software associated with information in the public domain or basic scientific research.

Explanatory notes to the Annex:

Microprogram – a sequence of elementary instructions, maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register.

Other element – an element other than hydrogen, uranium and plutonium.

Use – operation, installation (including on-site installation), and maintenance, including checking, repair, overhaul, or refurbishing.

Program – a sequence of instructions to perform a process that is in a form or transferable to a form that can be processed by a computer.

Software - a set of one or more programs or microprograms.

Technical data – may take the form of drawings, plans, diagrams, models, formulas, technical designs and specifications, manuals and instructions in written or digital form.

Technical assistance - may take the form of instruction, skills, training, working knowledge, consulting services, and may include the transfer of technical data.

Manufacturing – the production phase, e.g. construction, manufacturing engineering, manufacturing, integration, assembly, including fixing, inspection, testing, quality assurance.

Development - a pre-production phase, for example, design, research in the area of design, design analysis, design conceptualisation, prototype assembly and testing, pilot production schemas, construction information, the process of transforming construction information into a product, configuration design, integration design.

Technology – specific information needed for development, production, or use of any of the items in this annex; such information may take the form of technical information or technical assistance.

Public domain – technologies or software made available without restrictions for further use; copyright restrictions do not exclude technology or software from the public domain.

Basic scientific research – experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena and observable facts, not primarily directed towards a specific practical aim or objective.’

19. Annex 2 reads as follows:

‘Annex 2 to Decree No 375/2016

DECLARATION

of an end user of a selected item in the nuclear area

Information about an end-user who is a corporate entity

Name	
Registered office address	
Identification number	

Information about an end-user who is a natural person

Name(s) and surname	
Permanent address/domicile/place of business	
Date of birth	

Quantity, name and specification of the selected item in the nuclear area

Method and location of end-use of the selected item in the nuclear area

I declare that

a) I will not use the selected item in the nuclear area or any part thereof for any purpose that would be contrary to the Treaty on the Non-Proliferation of Nuclear Weapons or assist in the achievement of any military objectives;

b) I will make it possible to exercise safeguards and inspections by the State Office for Nuclear Safety (SONS), the European Community for Atomic Energy, and the International Atomic Energy Agency;

c) I will ensure physical protection in accordance with the Atomic Act;

d) I will not export a dual-use item in the nuclear area or a part thereof without the authorisation by the State Office for Nuclear Safety; and

e) I will notify the State Office for Nuclear Safety of transfer of a selected item in the nuclear area or part thereof.

....

Date and signature'.

Article II
Effective date

This Decree will come into effect on 1 March 2026.