DECREE

No. 375

of 7th November 2016

on selected items in the nuclear area

The State Office for Nuclear Safety sets, according to § 236 of Act No. 263/2016 Coll., the Atomic Act, to implement § 18(5), § 24(7), § 25(2)(d), § 166(6)(d), and § 169(4):

§ 1

Requirements for a declaration concerning the end-use of a selected item in the nuclear area

The declaration concerning the end-use of a selected item in the nuclear area, if subject to transfer, needs to include

a) the quantity, name and specification of a selected item in the nuclear area in compliance with this decree;
b) information about the type of end-use;
c) the date of the transfer;
d) data about the notifier, i.e.
   1. the name, or names, and surname if it is a natural person; or
   2. the name if it is a legal entity;
e) the address of the registered office, of the permanent residence or of domicile of the end-user;
f) the commitment of the end-user
   1. not to use a selected item in the nuclear area or its part for any purpose that would be in contradiction with the Nuclear Non-Proliferation Treaty;
   2. to ensure that a selected item in the nuclear area or its part is not abused for military purposes; and
   3. to ensure that the further transfer of a selected item in the nuclear area or its part in the Czech Republic is announced to the Office; and
g) the expected date when the information about the executed transfer of a selected item in the nuclear area is announced to the Office, following within the period of 30 working days after the transfer is executed.

§ 2

Content requirements for documentation for import, export or transit of nuclear items that are selected nuclear items

Documentation for authorised activity that is the import, export or transit of a selected nuclear item is a set of information similar to the information pursuant to § 3(1)(a) to (d).

§ 3

The scope and retention method and period for registered data on nuclear items that are selected nuclear items and deadlines for providing data to the office

(1) In the case of the export, import or transit of selected item in the nuclear area, the data need to be recorded in the following scope:

a) the quantity, name and specification of a selected item in the nuclear area, in compliance with this decree;
b) the name and address of the registered office of the supplier and the end-user of a selected item in the nuclear area, if these are legal entities, or their name or names and surname and permanent residence or address of domicile, if these are natural persons;
c) the draft of a contract and other business documents that are related to the export or import of a selected item in the nuclear area;
d) the date of the executed import, export or transit of a selected item in the nuclear area;
e) the date when the imported, exported or transited selected item in the nuclear area entered or left the Czech Republic;
f) in the case of import, information about when a selected item in the nuclear area was handed over to the end-user; and
g) written confirmation from the end-user about the receipt of a selected item in the nuclear area.

(2) The holder of the authorisation for export, import or transit of a selected item in the nuclear area must provide the Office with the data recorded according to paragraph (1)(a) to (g)

a) according to (1)(a) to (f) within five working days after the export, import or transit is completed; and
b) according to (1)(g) within 30 working days after a selected item in the nuclear area was handed over to the end-user.

(3) The holder of a permit for the export, import or transit of a selected nuclear item shall archive the recorded information for at least 3 years from their origin.

§ 4

List of selected items in the nuclear area

The list of selected items in the nuclear area is set by Annex 1 to this decree.

§ 5

End-user declaration template

The template for the end-user declaration of a selected item in the nuclear area during import is set by Annex 2 to this decree.

§ 6

Notification

This decree was notified in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

§ 7

Entry into force

This decree shall enter into force on 1st January 2017.

Chairperson:
Ing. Dana Drábová, Ph.D., v. r.

Annex 1 to Decree No .../...

THE LIST OF SELECTED NUCLEAR ITEMS SUBJECT TO CONTROLS DURING IMPORT, EXPORT, TRANSIT, AND TRANSFER

(SELECTED NUCLEAR MATERIALS, EQUIPMENT AND TECHNOLOGY)

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

Various types of nuclear reactors according to moderator type, neutron spectrum, coolant type or their function or type. The moderator types are mainly light water, heavy water or graphite or there are even nuclear reactors with no moderator. On a basis of the neutron spectrum the nuclear reactors are thermal or fast. Coolant types of the nuclear reactors are water, liquid metal, molten salt or gas. According to their function or type the nuclear reactors are divide into power reactors, research reactors and test reactors.
All items in this point include all of the listed nuclear reactor types. This point does not include fusion reactors.

1.1. Complete nuclear reactors

Nuclear reactors capable of sustaining a controlled fission chain reaction.
'Nuclear reactor' includes items that are located within a reactor vessel or that are directly connected to it, equipment that manages core output, and components that contain the coolant of the primary circuit of reactor, 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 core of a nuclear reactor as specified in Item 1.1, and nuclear reactor internals as defined 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-produced component of the reactor vessel.

1.3. Refuelling machines for nuclear reactors

Handling equipment, specially designed or prepared for inserting or removing nuclear fuel from a nuclear reactor as specified in Item 1.1, capable of replacing nuclear fuel during operation or of using technically complex elements for placing or orienting that permit the performance of a set of operations taking place during the replacement of nuclear fuel during nuclear reactor shutdown, when direct observation or access to nuclear fuel are usually not possible.

1.4. Nuclear reactor control rods and related equipment

Specially constructed or prepared rods, their load-bearing or suspensive structures, traction bars and guide tubes for managing the fission process in a nuclear reactor as specified in Item 1.1.

1.5. Nuclear reactor pressure tubes

Tubes that are specially designed or prepared to accept fuel elements and the primary cooling medium of a nuclear reactor as specified 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

Zirconium tubes or zircon alloy tubes (or tube systems), specially designed or prepared for use as cladding of nuclear fuel in a nuclear reactor as specified in Item 1.1, in amounts in excess of 10 kg.

Zirconium pressure tubes are classified under Item 1.5; tubes for heavy water reactor vessels are classified under Item 1.8.
Metal 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. Primary coolant pumps or circulators

Pumps or circulators that are specially designed or prepared to ensure the circulation of the primary cooling medium of a nuclear reactor as specified in Item 1.1. Specially designed or prepared pumps or circulators include pumps for water-cooled reactors, circulators for gas-cooled reactors and electromagnetic or mechanical pumps for liquid metal-cooled nuclear reactors.
These devices may include pumps with elaborate sealed or multi-sealed systems to prevent leakage of primary coolant, canned motor pumps and pumps with inertial mass systems.
These devices include pumps certified in accordance with Part III Section I Subsection NB of the American Society of Mechanical Engineers Code, or equivalent standards.

1.8. Nuclear reactor internals

Nuclear reactor internals specially designed or prepared for use in a nuclear reactor as specified in Item 1.1. Item 1.8, for example, includes load-bearing core structures, fuel channels, heavy water reactor vessel tubes, thermal shields, baffles, core grid plates and diffuser plates.
Nuclear reactor internals are defined as important structures within a reactor vessel, which have one or more functions such as supporting the core, maintaining fuel alignment, directing the flow of primary coolant, providing radiation shielding for the reactor vessel and guiding in-core instrumentation.

1.9. Heat exchangers

- **1.9.1.** 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.
- **1.9.2.** 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 equipment for transferring heat generated in a nuclear reactor to feed water for steam generation. 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 in reactor support systems such as emergency after-cooling systems or decay heat-cooling systems.

1.10. Neutron 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 internal and external devices that measure neutron flux levels over a large range, usually from 10^4 neutrons per cm^2/s to 10^{10} neutrons per cm^2/s or more.
Detectors outside a reactor core include devices outside the core of a nuclear reactor as specified in Item 1.1, which are located within the biological shielding.

1.11. External thermal shielding

External thermal shields specially designed or prepared for use in a nuclear reactor as specified in Item 1.1. to reduce heat losses and to protect the containment vessel.
External thermal shields are important structures placed over the reactor vessel that reduce a nuclear reactor's heat loss and lower the temperature inside the containment vessel.

2. Non-nuclear materials for reactors

2.1. Deuterium and heavy water

Deuterium, heavy water and other compounds of deuterium, in which the 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 any period of 12 months.

2.2. Nuclear grade graphite

Graphite with a purity of more than 5 parts per million boron equivalent and density greater than 1.5 g/cm^3 that is suitable for use in a nuclear reactor listed in Item 1.1, in quantities exceeding 1 kg for any one recipient country in any period of 12 months. The boron equivalent (BE) may be determined experimentally or calculated as the sum 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 the concentration of element Z (in ppm), CF is a conversion factor defined as follows:

$$CF = \frac{\delta_Z \times A_B}{\delta_B \times A_Z}$$

where δ_B a δ_Z are the effective thermal neutron capture cross-sections (in barns) for naturally-occurring boron and element Z respectively; and A_B a A_Z are the atomic masses of naturally-occurring boron and element Z respectively Z.

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, which are defined as equipment for chopping irradiated fuel elements, dissolving nuclear fuel, liquid extraction and storage of process solutions. Plants may also contain equipment for thermal denitrification of uranium nitrate, conversion of plutonium nitrate to oxide or metal, and for treatment of fission product waste liquor into a form that is suitable for long-term storage or disposal.

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

3.1. Machines for chopping irradiated fuel elements

Remotely operated equipment specially designed or prepared for use in the plant for reprocessing irradiated fuel elements, which are intended for cutting, chopping or shearing irradiated fuel assemblies, bundles or rods. This equipment breaches the cladding of the nuclear fuel and thus prepares the irradiated nuclear material for dissolution. Specially designed mechanical shears are most commonly used, but other equipment such as lasers may also be used.

3.2. Solvent tanks

Tanks secured against criticality (for example, a small diameter, annular, or slab design), specially designed or prepared for use in irradiated fuel element reprocessing plants, which are intended for dissolution of irradiated nuclear fuel in nitric acid and which are resistant to hot, highly corrosive liquid and can be remotely loaded and serviced.

Solvent tanks normally hold chopped-up irradiated nuclear fuel. In these vessels, secured against criticality, the irradiated nuclear material is dissolved in nitric acid and the remaining non-soluble parts are removed from the process stream.

3.3. Liquid extractors and liquid extraction equipment

Specially designed or prepared extractors such as packed and pulse columns, mixing and settling tanks or centrifugal reactors, intended for use in plants for the reprocessing of irradiated fuel elements. Liquid extractors must be resistant to corrosion by nitric acid.

Liquid extractors are normally produced under extremely high standards (including special welding, inspections, quality assurance and quality control) 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. Equipment for liquid extraction is usually designed to meet strict operating parameters, such as a long operating life without maintenance requirements, easy replacement, simplicity of operation and control, and flexibility under variable operating conditions.

3.4. Chemical holding or storage vessels

Specially designed or prepared holding or storage vessels intended for use in a plant for the reprocessing of irradiated nuclear fuel. These holding or storage vessels must be resistant to corrosion by nitric acid. They are usually manufactured from stainless steel, titanium, zirconium and other high-quality materials. Holding or storage vessels may be designed for remote control and maintenance and may have the following parameters in order to prevent criticality: walls or internal structures corresponding to a boron equivalent of at least 2 % or a maximum diameter of 175 mm for cylindrical vessels, or a maximum width of 75 mm for every slab or annular vessel.
Chemical holding or storage vessels are used for further processing of three main flows exiting the extraction operation: the pure nitric acid solution is concentrated through evaporation, and during the subsequent denitrification process is transformed to uranium oxide, where it is re-used in the nuclear fuel cycle. The highly radioactive fission products solution is normally 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. The pure plutonium nitrate solution is concentrated and stored until it is transformed for further process steps. Special holding or storage vessels for plutonium solutions are designed to prevent criticality problems caused by changes in the concentration and form of this solution.

3.5. Neutron measurement systems for process control

Neutron measurement systems specially designed or prepared for integration and use with automatic process control systems in plants for the reprocessing of irradiated fuel elements. These systems are capable of active and passive neutron measurement and discriminatory ability to stipulate the amount and mix of fissile materials. The system comprises 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

Plants for the fabrication of oxide-based fuel elements and parts thereof, which are facilities for pressing tablets, sintering, crushing, and sorting and plants for the fabrication of MOX type nuclear fuel. This item includes equipment that comes into direct contact with nuclear materials, directly processes or checks the production flow of nuclear material, hermetically seals nuclear material within the scope of cladding, checks the integrity of cladding and hermetic seals, checks the final finish of hermetically sealed nuclear fuel, or is used to complete fuel elements for nuclear reactors.
Items corresponding to 'equipment specially designed or prepared for fabrication of fuel elements' include, for example, fully automated inspection stends specially designed or prepared for checking the final dimensions and surface defects of tablets, automatic welding

machines specially designed or prepared for welding end covers of fuel elements (or rods), systems specially designed or prepared for fabricating nuclear fuel cladding, and automatic testing and inspection stends specially designed or prepared to check the integrity of completed fuel elements (or rods) – these usually include equipment for X-ray testing of welds on elements (or rods), equipment for detecting helium leaks from pressurised elements (or rods), and equipment for gamma scanning elements (or rods) in order to verify that 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

Gas centrifuges consisting of a thin-walled cylinder with a diameter of 75 mm to 650 mm placed in a vacuum and spun at high peripheral speed on the order of 300 m/s or more, around a vertical axis. Rotary component structural materials must have a high strength to density ratio in order to achieve the desired speed. The rotor assembly, and therefore its individual components, must be manufactured to very close tolerances in order to minimise imbalances during operation. 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 also include critical non-rotating parts that, though they are specially designed, are not made of special materials.

5.1.1. Rotating components

5.1.1.1. Complete rotor assemblies

Thin-walled cylinders or a number of interconnected thin-walled cylinders, which are made from one or more of the materials with a high strength to density ratio. If the cylinders are interconnected, they are connected by flexible bellows or rings as described in Item 5.1.1.3. The rotor is equipped with an internal deflector and end caps described in Item 5.1.1.4 and Item 5.1.1.5. The complete assembly may be delivered only partly assembled.

5.1.1.2. 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.

5.1.1.3. Rings or bellows

Components specially designed or prepared that allow placement of a support to the rotor tube or to join together a number of rotor tubes. Bellows are a coiled short cylinder with a diameter of 75 mm to 650 mm with a maximum wall thickness of 3 mm, made of a material with high strength to density ratio.

5.1.1.4. Baffles (deflectors)

Disc-shaped components with a diameter of 75 mm to 650 mm, specially designed or prepared to be fitted inside the centrifuge rotor tube in order to isolate the take-off chamber from the main separation chamber and, in some cases, to assist the circulation of UF_6 gas inside the main separation chamber of the rotor tube. They are made from a material with high strength to density ratio.

5.1.1.5. Top and bottom end caps

Disc-shaped components with a diameter of 75 mm to 650 mm specially designed or prepared to fit the ends of the rotor tube and contain the UF_6 within the rotor tube, and in some cases to support, retain or contain as an integral part an element of the upper bearing (top cap), or to carry the rotating elements of the motor and lower bearing (bottom cap). They are made from a material with high strength to density ratio.

For rotation parts of centrifuges as described in Item 5.1.1.1 to 5.1.1.5, high-strength steel is used, having an ultimate tensile strength of 1.95 GPa or greater; aluminium alloys having an ultimate tensile strength of 0.46 GPa or greater; or fibrous materials suitable for use in composite structures with a specific modulus of 3.18×10^6 m or greater and an 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 mass in N/m^3; the 'specific ultimate tensile strength' is the ultimate tensile strength in N/m^2 divided by the specific mass in N/m^3).

5.1.2. Static components

5.1.2.1. Magnetic suspension bearings

5.1.2.1.1. 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. Magnetic couples with a pole piece or a second magnet are attached to the top cap, as described in Item 5.1.1.5. The magnet may have an annular shape, where the maximum ratio of the outside diameter to the inside diameter is 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. Aside from the usual material properties, the deviation of the magnetic axis from the geometric axis is limited by very tight tolerances, less than 0.1 mm, or the magnet material is highly homogeneous.

5.1.2.1.2. Active magnetic bearings specially designed or prepared for use with gas centrifuges. These bearings usually have the following characteristics: they are designed to maintain centre rotor rotation up to at least 600 Hz, and are connected to a reliable power source or backup source (UPS) in order to maintain functionality for over 1 hour.

5.1.2.2. Bearings and dampers

Specially designed or prepared bearings comprising a pivot or 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 5.1.1.5 at the other. The shaft may also have a hydrodynamic bearing attached. The cup is pellet-shaped with a hemispherical indentation in one surface. These components are often supplied separately to the damper.

5.1.2.3. Molecular pumps

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

5.1.2.4. Motor stators

Specially designed or prepared annular stators for high-speed multiphase AC hysteresis or reluctance motors, prepared for synchronous operation within a vacuum in the frequency range of 600 Hz or greater and a power 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.

5.1.2.5. 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.

5.1.2.6. Blades

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 gas centrifuge enrichment plants

5.2.1. 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. 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.

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

5.2.1.2. Desublimers, cold traps or pumps used to eliminate UF_6 from the enrichment process for subsequent transport after heating.

5.2.1.3. 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.

5.2.1.4. 'Product' and 'tails' stations used for trapping UF_6 into containers.

5.2.2. Machine piping systems of collectors

Specially designed or prepared piping systems and header systems of collectors (hereinafter as "header") for handling UF_6 within centrifuge cascades. The piping network is normally a triple header system, where each centrifuge is connected to each of the headers. This arrangement is repeated many times. These systems are constructed of materials resistant to corrosion by UF_6 and manufactured such that they meet very high vacuum and cleanliness standards. 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.

5.2.3. Special shut-off and control valves

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

5.2.3.1. Shut-off valves specially designed or prepared for feed, product or tails UF_6 gas flows for individual gas centrifuges.

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

For this item, material resistant to UF6 is defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60 % nickel, and fluoropolymers.

5.2.4. UF_6 analysis mass spectrometers and ion sources

Specially designed or prepared mass spectrometers capable of on-line sampling from a stream of gaseous UF_6 that have:

5.2.4.1. the ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320;

5.2.4.2. 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;

5.2.4.3. electron bombardment ionisation sources; and

5.2.4.4. a collector system suitable for isotopic analysis.

5.2.5. Frequency changes

Frequency changers (also known as converters or inverters) specially designed or prepared to supply motor stators as described in Item 5.1.2.4, or parts, components, and sub-assemblies of such frequency changers having the following characteristics:

5.2.5.1. a multiphase frequency output of 600 Hz or more; and

5.2.5.2. high stability with frequency control better than 0.2 %;

5.3. Specially designed or prepared assemblies and components for use in gaseous 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

5.3.1.1. Specially designed or prepared thin porous filters with pore size of 10 to 100 nm, of thickness 5 mm or less, and in the case of a cylindrical shape with a diameter of 25 mm or less, made of metal, polymer or ceramic materials, resistant to corrosion by UF_6, which for this item are defined as copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or its alloys containing at least 60 % nickel, and fluoropolymers.

5.3.1.2. 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^{-6} m and a high degree of uniformity of particle size, which are specially adapted for the manufacture of gaseous 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 suction of 1 m^3/min. UF_6 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 pressure ratio of 10:1 or less and are 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.

5.3.4. Rotary shaft seals

Specially designed or prepared vacuum seals, which 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 in-leakage rate of less than 1 000 cm^3/min.

5.3.5. Heat exchangers for cooling UF_6

Specially designed or prepared heat exchangers 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 are designed for a maximum 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 gas diffusion enrichment plants

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. Measurement, regulation and control systems ensure strict and continuous maintenance of vacuum in all technological systems, automatic accident protection and precise automated regulation of gas flow. All surfaces that come into contact with the process gas are made of or protected by UF_6-resistant materials.

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

Specially designed or prepared systems or equipment 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, including:

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

5.4.1.2. Desublimers, cold traps or pumps used to eliminate UF_6 from the enrichment process for subsequent transport after heating.

5.4.1.3. 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.

5.4.1.4. 'Product' and 'tails' stations used for trapping 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 designed with a double system of headers, with each unit connected to each of the headers.

5.4.3. Vacuum systems

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

5.4.3.2. 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 may be designed as rotary or volume type. 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 alloys, aluminium oxide, nickel or its alloys containing at least 60 % nickel, and fluoropolymers.

5.4.5. UF_6 analysis mass spectrometers and ion sources

Specially designed or prepared mass spectrometers capable of on-line sampling from a stream of gaseous UF_6, which have:

5.4.5.1. the ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320;

5.4.5.2. 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;

5.4.5.3. electron bombardment ionisation sources; and

5.4.5.4. 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 made of or protected by UF_6-resistant materials. These items include:

5.5.1. Separation nozzles

Specially designed or prepared separation nozzles or assemblies thereof. Separation nozzles consist of curved slit channels with a curve radius less than 1 mm. They are made of 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 by weight, and fluoropolymers. Inside the nozzle there is a blade that splits the gas flowing through the nozzle into two fractions.

5.5.2. Vortex tubes

Specially designed or prepared vortex tubes or assemblies thereof. Vortex tubes are cylindrical or conical, made of or protected by 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 by weight, and fluoropolymers. The tubes have one or more tangential inlets and may have nozzles at one or both ends of the tube. Process gas enters the vortex tube tangentially at one end, or through swirl vanes or at numerous tangential positions along the periphery of the tube.

5.5.3. Compressors and gas blowers

Specially designed or prepared compressors or gas blowers made of or protected by material resistant to corrosion by UF_6 and the carrier gas of hydrogen or helium, 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 by weight, and fluoropolymers.

5.5.4. Rotary shaft seals

Specially designed or prepared vacuum seals for sealing feed and exhaust flanges serving to seal the shaft connecting the compressor rotor or the gas blower rotor with the driver motor so as to ensure a reliable seal against out-leakage of process gas or in-leakage of air or to 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 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 by weight, and fluoropolymers.

5.5.6. Separation element housings

Specially designed or prepared separation element housings made of or protected by 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 by weight, and fluoropolymers, housing vortex tubes or separation nozzles.

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

Specially designed or prepared enrichment plant systems or equipment 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 by weight, and fluoropolymers, including:

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

5.5.7.2. Desublimers or cold traps used to eliminate UF_6 from the enrichment process for subsequent transport after heating.

5.5.7.3. 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.

5.5.7.4. 'Product' and 'tails' stations used for trapping UF_6 into containers.

5.5.8. Header piping systems

Specially designed or prepared header piping systems for UF_6 transport inside aerodynamic cascades, 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 by weight, and fluoropolymers. This piping network is normally designed as a double header system with each stage or group of stages connected to each of the headers.

5.5.9. Vacuum systems and pumps

5.5.9.1. Specially designed or prepared vacuum systems consisting of vacuum manifolds, vacuum headers, and vacuum pumps and designed for service in UF_6.-bearing atmospheres.

5.5.9.2. Specially designed or prepared vacuum pumps for use in an environment containing UF_6, made of or protected by 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 by weight, and fluoropolymers. 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, manual or automatic, shut-off or control, made of or protected by 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 by weight, and fluoropolymers, with at least 40 mm diameter, which are installed on main and auxiliary systems of aerodynamic enrichment plants.

5.5.11. UF_6 analysis mass spectrometers and ion sources

Specially designed or prepared mass spectrometers capable of on-line sampling from a stream of gaseous UF_6 that have:

5.5.11.1. the ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320;

5.5.11.2. 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;

5.5.11.3. electron bombardment ionisation sources; and

5.5.11.4. 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 of 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:

5.5.12.1. Cryogenic heat exchangers or cryoseparators capable of temperatures of 153 K (-120 °C) or less.

5.5.12.2. Cryogenic refrigeration units capable of temperatures of 153 K (-120 °C) or less.

5.5.12.3. Separation nozzles or vortex tubes for the separation of UF_6 from the carrier gas.

5.5.12.4. UF_6 cryogenic separators capable of cryogenic separation of UF_6.

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

5.6.1. Liquid-liquid exchange columns (chemical exchange)
Countercurrent 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 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 of 30 seconds.

5.6.2. Liquid-liquid centrifugal extractors (chemical exchange)
Specially designed or prepared liquid-liquid centrifugal extractors for uranium enrichment using the chemical exchange process. Such extractors 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 columns and their internals are made of or protected by suitable plastic materials (such as fluorocarbon polymers) or glass. In the standard version, the reservoir in centrifugal extractors is designed for a maximum of 30 seconds.

5.6.3. Uranium reduction systems and equipment (chemical exchange)

5.6.3.1. 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 cathodic compartment must be designed to prevent re-oxidation of uranium to its higher valence states. 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.

5.6.3.2. Specially designed or prepared systems for taking the U^{+4} out of the organic stream at the product end of the cascade, adjusting the acid concentration and feeding to the 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 sulfate, polyether sulphone and resin-impregnated graphite).

5.6.4. Feed solution preparation systems (chemical exchange)
Specially designed or prepared systems for producing high-purity UCl_3 feed solutions for chemical exchange enrichment plants. 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. Parts of the system that process highly pure U^{+3} are made of glass, fluorocarbon polymers, polyphenyl sulfate, polyether sulphone 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:

5.6.5.1. Equipment for mixing chlorine and oxygen with the aqueous effluent from the isotope separation equipment and extracting the resultant U^{+4} into the stripped organic stream returning from the product end of the cascade.

5.6.5.2. 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)
Fast-reacting ion exchange resins or adsorbents specially designed or prepared for uranium enrichment using the ion exchange process, including porous macro-reticular resins, and/or pellicular structures in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure or other composite structures of suitable form 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 1 000 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. Ion exchange reflux systems (ion exchange)

5.6.8.1. Specially designed or prepared chemical or electrochemical reduction systems for regeneration of chemical reducing agents used in ion exchange uranium enrichment cascades. During ion exchange enrichment, Ti^{+3} can for example be used as the reducing cation. In this case, the reduction system would reduce Ti^{+4} and thus generate Ti^{+3}.

5.6.8.2. Specially designed or prepared chemical or electrochemical oxidation systems for regeneration of chemical oxidising agents used in ion exchange uranium enrichment cascades. During this process, Fe^{+3} can, for example, be used as the reducing cation. 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

Specially designed or prepared systems for the laser-based enrichment process include atomic vapour laser isotope separation where the process medium is atomic uranium vapour, and molecular vapour laser isotope separation, where the process medium is a uranium compound vapour, possibly mixed with other gas(es). The normal nomenclature for such processes includes: (first category) atomic vapour laser isotope separation, or (second category) molecular laser separation including chemical reaction by isotope selective laser activation. Current laser-based enrichment systems include: devices to feed uranium metal vapour (for selective photo-ionisation) or devices to feed the vapour of a uranium compound (for photo-dissociation or chemical activation), devices to collect enriched and depleted uranium metal as ‘product’ and ‘tails’ in the first category, and devices to collect dissociated or reacted compounds as ‘product’ and unaffected material as ‘tails’ in the second category, process laser systems to selectively excite the ^{235}U species, and feed preparation and product conversion equipment. 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.

Items specified in Item 5.7 that come into direct contact with gaseous or liquid uranium metal or with process gas consisting of UF_6 or a mixture of UF_6 with another gas have all surfaces that come into direct contact with uranium or UF_6, made of or protected by corrosion-resistant materials. For purposes of this item, materials resistant to corrosion by gaseous or liquid uranium metal or uranium alloys are, for example, graphite coated with yttrium and tantalum. For this item materials resistant to corrosion by UF_6 are defined as copper, copper alloys, stainless steel, aluminium, aluminium alloys, aluminium oxide, nickel or its alloys containing at least 60 % nickel by weight, and fluoropolymers.

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

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

5.7.2. Systems and components for handling liquefied 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 for 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 or uranium alloys are made of or protected by materials of suitable heat-resistant and corrosion-resistant materials. Suitable materials include graphite coated with yttrium oxide, 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' (enriched uranium) and 'tails' (depleted uranium) header assemblies for uranium metal in liquid or solid form. These collector assemblies are made of or protected by materials resistant to the heat and corrosion of uranium metal vapour or molten uranium (for example yttria-coated graphite or tantalum). This includes pipes, valves, fittings, grooves, bushings, heat exchangers and collector plate electrodes 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 the 'product' (enriched uranium) and 'tails' (depleted uranium) headers. These housings have openings for electrical and water bushings, laser beam windows, vacuum pump connections and instrumentation diagnostics and monitoring. They have provisions for opening and closure to allow refurbishment of internal components.

5.7.5. Ultrasonic expansion nozzles (molecular uranium vapour separation methods)

Specially designed or prepared supersonic expansion nozzles for cooling mixtures of UF_6 and carrier gas to 150 K (-123 °C) or less that are resistant to corrosion by UF_6. For this item materials resistant to corrosion by UF_6 are defined as copper, copper alloys, stainless steel, aluminium, aluminium alloys, aluminium oxide, nickel or its alloys containing at least 60 % nickel by weight, and fluoropolymers.

5.7.6. 'Product' and 'tails' collectors (molecular uranium vapour 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. 'Product' collectors may include a filter, impact, or cyclone type headers or combinations thereof, and made of materials resistant to corrosion by UF_5 or UF_6.

5.7.7. Compressors for process gas and UF_6 (molecular uranium vapour separation methods)

Specially designed or prepared compressors for UF_6/carrier gas mixtures, designed for long-term operation in a UF_6 environment. Components of these compressors that come into contact with process gas are 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 by weight, and fluoropolymers.

5.7.8. Shaft seals (molecular uranium vapour separation methods)

Specially designed or prepared rotary shaft seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor with the driver motor so as 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 uranium vapour separation methods)

Specially designed or prepared systems for fluorination of U_5 (in solid form) to U_6 (gas), which is subsequently collected in 'product' containers or immediately feeds additional enrichment units.

5.7.10. UF_6 analysis mass spectrometers and ion sources (molecular uranium vapour separation methods)

Specially designed or prepared mass spectrometers capable of on-line sampling from a stream of gaseous UF_6 that have:

5.7.10.1. the ability to measure ions with an atomic mass of 320 or greater and a unit resolution better than 1:320;

5.7.10.2. 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;

5.7.10.3. electron bombardment ionisation sources; and

5.7.10.4. a collector system suitable for isotopic analysis.

5.7.11. Feed systems and systems for removal of 'products' and 'tails' (molecular uranium vapour separation methods)

Specially designed or prepared enrichment plant systems or equipment made of or protected by 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 by weight, and fluoropolymers:

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

5.7.11.2. Desublimers or cold traps used to eliminate UF_6 from the enrichment process for subsequent transport after heating.

5.7.11.3. 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.

5.7.11.4. 'Product' and 'tails' stations used for trapping UF_6 into containers.

5.7.12. Systems for separation of UF_6 from process gas (molecular uranium vapour separation methods)

Specially designed or prepared process systems for separating UF_6 from carrier gas. The carrier gas may be nitrogen, argon or other gas. These systems may include the following equipment:

5.7.12.1. Cryogenic heat exchangers or cryoseparators capable of temperatures of 153 K (-120 °C) or less.

5.7.12.2. Cryogenic refrigeration units capable of temperatures of 153 K (-120 °C) or less.

5.7.12.3. UF_6 cryogenic separators capable of cryogenic separation of UF_6.

5.7.13. Laser systems

Lasers or laser systems specially designed or prepared for the separation of uranium isotopes. A laser system usually contains optical and electronic components for guiding beams and transmission to the isotope separation cell. Laser systems for atomic uranium vapour separation methods usually consist of two lasers: dye-based tunable lasers augmented by a different laser type; for example, a copper vapour laser or a solid-state laser. Laser systems for molecular uranium vapour separation methods usually consist of CO_2 lasers or excimer lasers and a multi-pass optical cell. Lasers or laser systems utilising both methods require wavelength stabilisation for long-term operation.

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

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 ion generation or acceleration that have frequencies greater than 30 GHz and capable of handling more than 50 kW mean power.

5.8.2. Ion excitation coils

Specially designed or prepared radio-frequency ion excitation coils for frequencies greater 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. Uranium metal 'product' and 'tails' header assemblies

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

5.8.5. Separator module housings

Cylindrical vessels specially designed or prepared for use in plasma separation enrichment plants for containing the uranium plasma source, radio-frequency drive coil and the 'product' and 'tails' headers. These housings have openings for electrical bushings, diffusion pump connections and diagnostics and monitoring system sensors. They have provisions for opening and closure to allow for replacement 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

Electromagnetic isotope separators specially designed or prepared for the separation of uranium isotopes, and equipment and components intended for this purpose:

5.9.1.1. Ion sources

Specially designed or prepared single or multiple uranium ion sources consisting of a vapour source, ioniser 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.

5.9.1.2. Ion headers

Header plates consisting of two or more slits and pockets specially designed or prepared for collection of enriched and depleted uranium ion beams and made of materials such as graphite or stainless steel.

5.9.1.3. Vacuum housings

Specially designed or prepared vacuum housings for electromagnetic separators, made of non-magnetic materials such as stainless steel and designed for operation at pressures of 0.1 Pa or lower. Housings are specially designed to contain ion sources, collection plates and water-cooled liners, have provisions for diffusion pump connection, and may have openings for removal and re-installation of internal components.

5.9.1.4. 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 the following characteristics:

5.9.2.1. capable of continuous operation;

5.9.2.2. input voltage of 20 kV or greater;

5.9.2.3. output current of 1 A or greater;

5.9.2.4. voltage regulation better than 0.01 % over 8 hours.

5.9.3. Electromagnet power supplies

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

5.9.3.1. the ability to continuously deliver output current of 500 A or greater at a voltage of 100 V or more; and

5.9.3.2. current or voltage regulation better than 0.01 % over 8 hours.

6. Plants for the production or modification of concentration of heavy water, deuterium and its compounds and devices specially designed or prepared for this purpose

Equipment which is especially designed or prepared for the production of heavy water utilising either the water-hydrogen sulfide exchange process or the ammonia-hydrogen exchange process include 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 sulfide exchange columns

Ammonia-hydrogen exchange columns with diameters of at least 1.5 m capable of operating at pressures equal to or greater than 2 MPa, specially designed or prepared for heavy water production utilising the ammonia-hydrogen exchange process.

6.2. Blowers and compressors

Single stage, low head centrifugal blowers working with pressure of 0.2 MPa 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 sulfide exchange process. These blowers or compressors have a minimum output of 56 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 columns with a minimum height of 35 m and diameter of 1.5-2.5 m 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 columns also have at least one flanged, axial opening of the same diameter as the cylindrical part through which the tower internals can be inserted or withdrawn.

6.4. Column internals and stage pumps

Column internals and stage pumps specially designed or prepared for columns for heavy water production utilising the ammonia-hydrogen exchange process. Column internals include specially designed stage contactors that ensure the best possible gas/liquid contact. Stage pumps are specially designed submersible pumps for circulation of liquid ammonia within a contacting stage and for ammonia transport to the column stages.

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. Infrared absorption analysers

Infrared absorption analysers capable of on-line hydrogen/deuterium ratio analysis where deuterium concentrations are equal to or greater than 90 %.

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 intended for this purpose

Complete heavy water upgrade systems or columns specially designed or prepared for achieving deuterium concentration required for use in a nuclear reactor. These systems, which usually employ water distillation to separate heavy water from light water, are specially designed or prepared distillation units that produce reactor-grade heavy water (typically 99.75 % deuterium oxide) from heavy water feedstock of lesser concentration.

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 receive the synthesis gas (nitrogen and hydrogen) from an ammonia/hydrogen high-pressure exchange column and the synthesised ammonia is returned to said column.

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, defined as the 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 of the uranium conversion processes, items of equipment which individually are not specially designed or prepared for uranium conversion can be assembled into systems which are specially designed or prepared for use in uranium conversion.

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

Systems for conversion of uranium ore concentrates to UO_3 by dissolving ore in HNO_3 and extraction of pure $UO_2(NO_3)_2$ with the use of $C_{12}H_{27}O_4P$ as solvents. $UO_2(NO_3)_2$ is then converted to UO_3 either using concentration and denitrification or neutralisation with ammonia gas until the creation of $(NH_4)_2U_2O_7$ with subsequent filtering, drying and baking.

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

Systems for the conversion of UO_3 to UF_6 through direct fluorination using fluorine gas or ClF_3 as sources of fluorine.

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

Systems for conversion of UO_3 to UO_2 through the reduction of UO_3 by cracked ammonia gas or hydrogen.

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

Systems for conversion of UO_2 to UF_4 based on a reaction of UO_2 with gaseous HF at 300-500 °C.

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

Systems for conversion of UF_4 to UF_6, through an exothermic reaction with fluorine in column reactors, where UF_6 is condensed in hot effluent gases while passing through a cold trap cooled to -10 °C. This process requires a source of fluorine gas.

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

Systems for conversion of UF4 to uranium metal by reduction with magnesium (large batches) or calcium (small batches). The reaction is carried out at temperatures above the melting point of uranium (1 130 °C).

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

Systems of conversion of UF_6 to UO_2 through reduction of UF_6 and hydrolysis to UO_2 with the use of hydrogen and steam, or hydrolysis of UF_6 by dissolution in water and precipitation of $(NH_4)_2U_2O_7$ by adding ammonia, where $(NH_4)_2U_2O_7$ is then reduced to UO_2 using hydrogen at 820 °C, or through reaction of gaseous UF_6, CO_2 and ammonia gas in water, precipitating $UO_2(CO_3)_3(NH_4)_4$. When $UO_2(CO_3)_3(NH_4)_4$ reacts with steam and hydrogen at 500-600 °C, the result is UO_2.

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

Systems for conversion of UF_6 to UF_4 through reduction by hydrogen.

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

Systems for the conversion of UO_2 to UCl_4 through reaction of UO_2 with CCl_4 at approximately 400 °C, reaction of UO_2 at approximately 700 °C in the presence of soot (CAS 1333-86-4), CO, and chlorine, producing 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, in which $Pu(NO_3)_3$ is converted to PuO_2, PuO_2 is converted to PuF_4, and PuF_4 is converted to plutonium metal.

In all of the plutonium conversion processes, items of equipment which individually are not specially designed or prepared for plutonium conversion can be assembled into systems which are specially designed or prepared for use in plutonium conversion.

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

Systems for the conversion of plutonium nitrate to oxide using precipitation, separation and calcination processes. The process systems are particularly adapted so as to avoid criticality and radiation effects and to minimise toxicity hazards.

7.2.2. Specially designed or prepared systems for plutonium metal production

Systems for the production of plutonium metal through fluorination of plutonium oxide with highly corrosive hydrogen fluoride in order to produce plutonium fluoride, which is reduced through the use of highly pure calcium metal to obtain plutonium metal, or fluorination with plutonium oxalate with subsequent reduction to metal, or fluorination of plutonium peroxide with subsequent reduction to metal. The process systems are particularly adapted so as to avoid criticality and radiation effects and to minimise toxicity hazards.

8. Packaging for irradiated nuclear fuel and hot cells

8.1. Packaging for irradiated nuclear fuel

Packaging for the transportation and/or storage of irradiated nuclear fuel, which provides chemical, thermal and 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 related to information in the public domain or basic scientific research.

Notes for the annex:

Microprogramme – 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 or plutonium.

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

Programme – 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 file containing one or more programmes or microprogrammes on any physical medium.

Technical information – a drawing, plan, diagram, model, formula, technical design or specification, manual or instructions in written form, or data recorded on media.

Technical assistance – instructions, skills, training, work experience, consulting service; technical assistance may also include technical information.

Manufacturing – a production phase, for example, construction, manufacturing engineering, manufacture, integration, installation (attachment), checking, 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 – technology or software that has been made available without restrictions on its further use; copyright-related restrictions do not disqualify technologies 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.

Annex 2 to Decree No .../…

Declaration

by the end-user of a selected item in the nuclear area

Information on an end-user that is a corporate subject

Name:
Registered offices:
Identification number:

Information on an end-user that is a natural person

Name(s) and surname(s):
Address of Residency:
Date of birth:

Specification of the nuclear item that the declaration concerns

Use and purpose of the nuclear item that the declaration concerns

I declare that

a) I shall not use the selected item in the nuclear area or part thereof for any purposes contrary to the Treaty on the Non-Proliferation of Nuclear Weapons or to help achieve any military objectives;
b) I shall make it possible to apply guarantees and control by the State Office for Nuclear Safety (SONS), the European Community for Atomic Energy, and the International Atomic Energy Agency;
c) I shall ensure physical protection in accordance with the Atomic Act;
d) I shall not export a selected item in the nuclear area or part thereof without the authorisation of the State Office for Nuclear Safety; and
e) I shall notify the State Office for Nuclear Safety of transfer of the selected item in the nuclear area or part thereof.

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Date and signature