DECREE
OF THE PRESIDENT OF THE RUSSIAN FEDERATION
NO. 202 OF FEBRUARY 14, 1996
ON THE APPROVAL OF THE LIST OF NUCLEAR MATERIALS, EQUIPMENT, SPECIAL NONNUCLEAR MATERIALS AND THE PROPER TECHNOLOGIES THAT ARE SUBJECT TO EXPORTS CONTROL

(with the Amendments and Addenda of January 21, May 12, 1997, May 5, June 21, 2000)

See the Regulations on the Implementation of Control of Foreign Trade Activities Involving the Dual Use Equipment and Materials and Also Relevant Technology Used for Nuclear Purposes approved by Decision of the Government of the Russian Federation No. 462 of June 14, 2001

On the export and import of nuclear materials, equipment, special non-nuclear materials and corresponding technologies, see Decision of the Government of the Russian Federation No. 973 of December 15, 2000

Decree of the President of the Russian Federation No. 1151 of June 21, 2000 amended this Decree
The amendments shall enter into force from official publication date of the said Decree

About the procedure for control over the export from the Russian Federation of the equipment and of materials of dual designation and of the respective technologies, used for nuclear purposes, whose export is under control see Decision of the Government of the Russian Federation No. 575 of May 8, 1996

In execution of the present Decision, the Order of the State Customs Committee of Russia No. 402 of June 27, 1996 was issued

In order to ensure compliance with international obligations of the Russian Federation with regard to nuclear nonproliferation, I resolve:

Decree of the President of the Russian Federation No. 798 of May 5, 2000 amended Item 1 of this Decree
The amendments shall come into force as of April 1, 2000
See the previous text of the paragraph

1. To approve the appended List of nuclear materials, equipment, special nonnuclear materials and the proper technologies that are subject to exports control, submitted by the Government of the Russian Federation.

To establish that the codes of the commodity classification of the foreign economic activity mentioned in a List of Nuclear Materials, Equipment, Special Non-nuclear Materials and Respective Technologies Liable to Export Control may be, if need be, updated by the State Customs Committee of the Russian Federation under the agreement of the Federal Currency and Export Control Service of the Russian Federation with the aim of bringing these in accord with the international base of the Commodity Classification of the foreign economic activity of the Commonwealth of Independent States and with the Commodity Classification of Foreign Economic Activity of the Russian Federation.

2. This decree shall come into force three months after its official publication.

See Regulations for the Export and Import of Nuclear Materials, Equipment, Special Non-nuclear Material and Relevant Technologies approved by Decision of the Government of the Russian Federation No. 574 of May 8, 1996

President of the Russian Federation Boris Yeltsin

LIST
OF NUCLEAR MATERIALS, EQUIPMENT, SPECIAL NONNUCLEAR MATERIALS AND THE PROPER TECHNOLOGIES THAT ARE SUBJECT TO EXPORTS CONTROL
(Approved by the Decree of the President of the Russian Federation No. 202 of February 14, 1996)

See the List of Nuclear Materials, Equipment, Special Non-nuclear Materials and the Proper Technologies That Are Subject to Exports Control approved by Order of the State Customs Committee of the Russian Federation No. 436 of May 29, 2000

On changing codes of CC FEA see Amendments approved by Decree of the President of the Russian Federation No. 468 of May 12, 1997

Decree of the President of the Russian Federation No. 468 of May 12, 1997 replaced the title of column "Name" with the title "Name"*

Number of positions	Name*	Code of CC FEA (Commodity Classification of Foreign Economic Activity)

Section 1. Nuclear materials

1.1.	Source material:	
1.1.1.	Uranium with the proportion of isotopes equal to that in natural uranium, in the form of metal, alloy, chemical combination or concentrate	284410000
1.1.2.	Uranium depleted by isotope 235 in the form of metal alloy, chemical combination or concentrate	284430110; 284430190
1.1.3.	Thorium in the form of metal, alloy, chemical combination or concentrate	284430510; 284430590
1.2.	Special fissionable material:	
1.2.1.	Plutonium-239	284420990
1.2.2.	Uranium-233	284440000
1.2.3.	Uranium enriched by isotope 235 or 233	284420110; 284420190

Definition

The term "Uranium enriched by isotope 235 or 233" means uranium with such contents of isotope 235 or 233 or both of them that the proportion of the sum of these isotopes as opposed to isotope 238 exceeded the proportion of isotope 235 as opposed to isotope 238 in natural uranium

1.2.4.	Any material containing one or several substances specified in item 1.2.1-1.2.3 in the form of metal, alloy, chemical combination, fresh or used reactor fuel	284420 284450000; 840130000
1.2.5.	Technologies related to the materials included in	

Section 1 of this List

Note: Exports control for plutonium with the isotopic concentration of plutonium-238 exceeding 80% shall be conducted according to the procedure established by the Federal legislation with regard to exports of equipment and materials of dual application as well as the proper technologies used for nuclear purposes

See Regulations of the Procedure for Control over the Export from the Russian Federation of the Equipment and of Materials of Dual Designation Whose Export is under Control approved by Decision of the Government of the Russian Federation No. 575 of May 8, 1996

1.3. Neptunium-237	284440000

Section 2. Equipment and Nonnuclear Materials

Decree of the President of the Russian Federation No. 1151 of June 21, 2000 amended Section 2 of this List

The amendments shall enter into force from official publication date of the said Decree

Decree of the President of the Russian Federation No. 468 of May 12, 1997 reworded Item 2.1.

see the previous text of the Item

2.1. Nuclear reactors and the equipment and components thereof specially designed or prepared:

2.1.1. Complex reactors Nuclear reactors operating in the mode of controlled self-support fission chain reaction	840110000

Note: The nuclear reactor mainly includes items located inside the reactor vessel or directly attached to it, equipment controlling the capacity in the core and their parts that are usually contained in the primary coolant, come into direct contact with it and regulate it

Decree of the President of the Russian Federation No. 468 of May 12, 1997 reworded Items 2.1.2. - 2.1.5.

see the previous text of the Items

2.1.2. The vessels of nuclear reactors Factory-manufactured metal vessels specially designed or prepared assembled or their components for the placement of core of nuclear reactors in them, as specified in Item 2.1.1, and the inner parts of the reactors as specified in Item 2.1.8.	840140100

Note: the upper part of the reactor vessel is covered by item 2.1.2 as the main factory-manufactured part of the reactor vessel

2.1.3. Machines for loading and unloading nuclear reactor fuel Handling equipment that was specially designed for loading and extracting fuel from nuclear reactors, as specified in Item 2.1.1.	842619000 842699900

Note: The machinery as specified in item 2.1.3 is used when reactor is under load or possess the technical capabilities for precise positioning or orienting to allow the performance of complicated fuel reloading operations on the stopped reactor that usually make the immediate supervision and direct access to the fuel impossible

2.1.4. Nuclear reactor control rods and equipment — 840140900

Rods specially designed or prepared, support or suspended structures for them, drives or guide tubes for the rods used for controlling the fission process in nuclear reactors, as specified in Item 2.1.1.

2.1.5. High pressure reactor tubes for nuclear reactors — 7304, 840140900, 750712000, 760820, 810990000

Tubes specially designed or prepared for placing in them fuel elements and primary coolant in nuclear reactors, as specified in Item 2.1.1, with the operational pressure exceeding 50 atmospheres;

2.1.6. Zirconium tubes

Tubes or assemblies of tubes made of metallic zirconium or its alloys specially designed or prepared for the use in nuclear reactors, as specified in item 2.1.1., with the proportion of hafnium as opposed to zirconium totaling less than 1:500 — 8100990000

2.1.7. Pumps of the primary coolant

Pumps specially designed or prepared for supporting circulation of the primary coolant in nuclear reactors, as specified in item 2.1.1. — 841381900

Note: Specially designed or prepared pumps may include complex, compacted or multiply compacted systems for preventing leaks of primary coolant, airtight pumps and pumps with inertial mass system. This definition applies to pumps certified as class NC-1 or as an equal standard

Decree of the President of the Russian Federation No. 468 of May 12, 1997 supplemented Section 2 with Items 2.1.8 - 2.1.10

2.1.8. Inner parts of nuclear reactors — 840140900, 840140100

Specially designed or prepared inner parts for the use in nuclear reactors as they are specified in Item 2.1.1, including supporting columns of the core, fuel channels, thermal screens, partitions, tube lattice of the core and diffusor plates

Note: The inner parts of nuclear reactors are the major structural elements inside the reactor vessel and they have one or several purposes such as the support of the core, holding in place the fuel assemblies, directing the flow of the primary coolant, providing irradiation protection for the reactor vessel and controlling the equipment inside the core

2.1.9. Heat exchangers — 841950900, 840420000, 840219900

Specially designed or prepared heat exchangers (steam generators) to be used in the primary coolant circuit of nuclear reactors as they are specified in Item 2.1.1.

Note: Specially designed or prepared steam generators for exchanging the heat generated in the reactor (primary circuit), water (secondary circuit) for steam generation. For fast breeder reactors having a liquid-metal coolant intermediary circuit, the heat exchangers transferring heat from the primary circuit to the intermediary cooling circuit are also subject to control like steam generators. Under this item not subject to control are the heat exchangers of emergency cooling system or residual heat removal system

2.1.10. Equipment for detecting and measuring neutron flux 903010900

Specially designed or prepared equipment for detecting neutrons and measuring the level of neutron flux inside the core of reactors, as they are specified in Item 2.1.1.

Note: Under this item, subject to exports control is the equipment located either inside or outside the core and capable of measuring high levels of flux, normally from 104 neutron/sq. cm's to 1,010 neutron/sq.cm's and higher. The equipment positioned outside the reactor's core include the equipment located inside the biological protection beyond the core of reactors as they are specified in Item 2.1.1.

2.2. Nonnuclear materials for reactors:

2.2.1. Deuterium and heavy water 284510000;

Deuterium, heavy water (deuterium oxide) and any other combination of deuterium in which the proportion of deuterium as opposed to atoms of hydrogen exceeds 1:5000, designed for use in nuclear reactors, as specified in item 284590100

2.2.2. Nuclear pure graphite

Graphite with the degree of purity higher than 0.000005 of that of the boric equivalent and density exceeding 1.50 gram per cubic santimeter, designed for use in nuclear reactors, as specified in item 2.1.1. 3801

Decree of the President of the Russian Federation No. 468 of May 12, 1997 supplemented Item 2.2.2. with the explanatory note

Note: The value of boric equivalent in parts per million (BE) may be determined experimentally or computed as a sum of the values of boric equivalents of admixtures (BEz) including boron and excluding the boric equivalent of carbon carbon is not considered as admixture) per the formula:

(BEz)ppm = [(sz+Ab)/(sb+Az)] + Zppm, where:

sb and sz are the values of effective section of the capture of thermal neutrons (in barn) ofnatural boron and element Z respectively

Ab and Az are the values of atomic mass of natural boron and element Z respectively
Zppm is the concentration of element Z in parts per million;

2.3. Installments and equipment specially designed or prepared for processing irradiated fuel elements:

Note:

When processing irradiated nuclear fuel, plutonium and uranium are separated from highly active fission products and other transuranium elements. For this separation different technological processes may be used, however, eventually, the "Purex" process became the most popular and acceptable. This process includes dissolution of irradiated nuclear fuel in nitric acid with the further separation of uranium, plutonium and fission products by extraction solvent with the help of tributil phosphate in the organic solvent.

Technological processes are similar at different facilities of the "Purex" type and include: milling of irradiated fuel elements, dissolution of fuel, extraction by solvent and storage of technological liquid substances. There may also be equipment for thermal denitration of uranium nitrate, conversion of plutonium nitrate into an oxide or a metal as well as for processing liquid wastes containing fission products until the form applicable for long-term storage or disposal is obtained.However concrete types and configurations of equipment carrying out these functions may vary at different facilities of the "Purex" type for different reasons including the type and quantity of irradiated nuclear fuel that is subject to processing and the presumed process of deposition of the extracted materials as well as principles of ensuring safety and maintenance intrinsic to the construction of a given facility.

These processes including complete systems for conversion of plutonium and production of metallic plutonium, may be identified via measures undertaken for preventing threats related to the critical character (for example measures related to geometry), irradiation (for example via irradiation protection) and toxicity (for example deterrence measures).

2.3.1. Installments for processing irradiated fuel elements

Installments for processing irradiated fuel elements include equipment and components that are usually placed in direct contact with the irradiated fuel and major technological flows of nuclear material and fission products and that immediately control them.

2.3.2. Equipment specially designed for the use at facilities for processing irradiated fuel elements:

2.3.2.1. Milling machines for irradiated fuel elements Equipment with remote control specially designed and prepared for the use at processing facilities, as specified in item 2.3.1., for cutting, chopping or assembly incision, bunches or rods of irradiated nuclear fuel	8456; 846231900; 846239990; 847982000

Note:

This equipment is used for opening fuel cover for the further dissolution of irradiated nuclear material. As a rule, devices specially designed and prepared for metal chopping, though more advanced equipment such as lasers may be used as well.

2.3.2.2. Dissolvents Reservoirs safe from critical perspective (for example small diameter circular or rectangular reservoirs) specially designed and prepared for the use at processing facilities, as specified in item 2.3.1, for dissolution of irradiated nuclear fuel, that are capable of withstanding hot high corrosion liquid substance and may be loaded and maintained	730900; 847989800

Note:

Milled used fuel is usually directed to dissolvents. In these reservoirs safe from critical perspective, irradiated nuclear material is dissolved in nitric acid and the remaining cover odds are lead out from the technological flow

2.3.2.3. Extractors and equipment for solvent extractions 847989800

Extractors with solvent such as nozzle and pulse columns, mixer-settlers specially designed and prepared for the use at irradiated fuel processing facilities.

Solvent extractors must be resistant to nitrin acid corrosion, produced in conformity with extremely high standards (including application of special welding methods, inspections, quality maintenance and control) stainless metals with small contents of carbon, titanium, zirconium or other high quality materials

Note:

Solvent extractors are added both a solution of irradiated fuel from dissolvents and the organic solution with the help of which separation of uranium, plutonium and fission products is possible. Equipment for solvent extraction is usually designed to meet strict exploitation requirements such as long-term non-maintenance service or easy replacement, simplicity in exploitation and control as well as flexibility with regard to altering the process parameters

2.3.2.4. Chemical reservoirs for curing and storage 730900300; 731010000

Reservoirs specially designed and prepared for curing and storage for the use at irradiated fuel processing facilities, resistant to nitric acid corrosion, made of stainless steels with low contents of carbon, titanium or zirconium or other high quality materials. Reservoirs for curing or storage may be designed for remotely controlled exploitation and maintenance and may have the following peculiarities from the perspective of nuclear criticality control:

1) the boric equivalent of walls and internal constructions equals at least 2% or

2) the maximal diameter of cylindrical reservoirs totals 175mm (7 inches) or

3) the maximal width of circular or rectangular totals 75mm (3 inches)

Note:

At the stage of solvent extraction three major technological flows of liquid substances are created. Reservoirs for curing or storage are used in the further processing of the three flows as follows:

a) a solution of uranium nitric oxide is concentrated by evaporation then the denitration process occurs where it turns into uranium oxide. This oxide is repeatedly used in the nuclear fuel cycle;

b) a solution of highly active fission products is usual concentrated by evaporation and stored in the form of concentrated liquid substance.

This concentrate may furtherly undergo evaporation and be converted into a form applicable for storage or disposal;

c) a solution of pure plutonium nitrate is concentrated and stored until its further use at new stages of technological process. Reservoirs for curing and storing plutonium solutions are particularly constructed to avoid criticality related problems arising as a result of alteration of the concentration and form of a given flow

2.3.2.5. System of conversion of plutonium nitrate into an oxide

Specially designed and prepared closed systems for conversion of plutonium nitrate into plutonium oxide are particularly equipped to avoid reaching critical level and radiation effects as well as to minimize risks related to toxicity

Note:

At majority of processing facilities the final process includes the conversion of plutonium nitrate solution into plutonium dioxide. Major operations of this process include storage and correction of the source technological material, disposition and separation of the solid and liquid phases, puncturing, treatment of product, ventilation, treatment of wastes and process control

2.3.2.6. System of conversion of plutonium oxide

Closed systems specially designed and prepared for production of metallic plutonium are particularly equipped to avoid critical level and radiation effects as well as to minimize the risk of toxicity

Note:

This process that may be related to processing facility includes fluorine impact upon plutonium dioxide usually via application of highly active hydrogen fluorine in order to obtain plutonium fluorine which is furtherly restored with the help of highly pure metallic calcium until metallic plutonium and calcium fluorine are obtained in the form of slag. Major operations of this process include fluorine impact (for example with the help of equipment containing precious metals or protection coating made of them), restoration of metal (for example with application of ceramic crucibles), restoration of slag, treatment of product,
ventilation, treatment of wastes and process control

Decree *of the President of the Russian Federation No. 468 of May 12, 1997 reworded Item 2.4.*
see the previous text of the Item

2.4. Plants for manufacturing fuel elements for nuclear reactors and the equipment for them specially designed or prepared

Introductory note: Nuclear fuel elements are manufactured from one or more initial or special fissionable materials listed in Section 1 of this List. For the most typical oxide kind of fuel the plants are represented by the equipment for pressing, baking, polishing and grading of tablets. Handling of mixed oxide fuel is performed in glove-boxes or equivalent equipment prior to its being put in a shell. In any event fuel is welded air-tight inside an appropriate shell which is elaborated both for primary package enveloping the fuel and to provide proper operational characteristics and safety while it is being used in reactor. Also in all events control is necessary at the highest level of the processes, operations and equipment so as to guarantee the forecast and safe operational characteristics of fuel

Note: The kinds of equipment which is considered to be covered by the term "and specially designed and prepared equipment" for the manufacturing of fuel elements include the following equipment which:

a) normally gets into direct contact or directly processes or controls technological line of nuclear material

b) perform the welding of the vessel inside of which there is nuclear material;

c) checks up the integrity of the shell or welded seam;

d) verifies the characteristics of the fuel enclosed in a shell

Such equipment or equipment systems may include the following:

1) specially designed or prepared fully automated plants for tablets control to verify the final

dimensions and surface defects of fuel tablets;

2) specially designed or prepared welding automatic machines for welding-on of end plugs for fuel rods;

3) specially designed or prepared automatic plants for testing and control to verify the integrity of fuel rods assemblies. Normally these plants include the equipment for:

a) x-ray inspection of the welded seams of the rods and end plugs;

b) detection of helium leakage from air-tight rods;

c) gamma-scanning of rods to verify them being filled up correctly with fuel tablet;

2.5. Facilities and equipment specially designed or prepared for separation of uranium isotopes, except for analytical devices:

2.5.1. Facilities for separation of uranium isotopes 84012000

2.5.2. Equipment specially designed or prepared for separation of uranium isotopes except for analytical devices:

2.5.2.1. Specially designed or prepared gas centrifuges and items and components used in gas centrifuges 84012000

Notes:

The gas centrifuge usually consists of cylinder(s) with thin walls and diameter ranging from 75mm (3 inches) up to 400mm (16 inches) with the central vertical axis, placed in vacuum and revolving with circular speed totaling about 300 meters per second and more. In order to achieve a higher speed, construction materials of revolving components must possess a high proportion between the solidity and density, and the rotor assembly and subsequently its components must be manufactured with a high degree of precision in order to minimize disbalance. As opposed to other centrifuges, the gas centrifuge used for uranium enrichment has inside the rotor chamber a revolving closure in the form of disk and permanent gas UF6 feeding and removal system consisting of at least three separate channels two of which are linked to blades directed from the rotor axis to peripheral part of the rotor chamber. A number of important nonrevolving elements is also placed in vacuum. Despite a special design, they are not difficult to manufacture and are not manufactured of unique materials. The centrifugal facility requires a large number of these components so their quantity may serve as an indicator of the final use.

2.5.2.1.1. Revolving components

2.5.2.1.1.1. Complete rotor assemblies 84012000

Cylinders or a number of cylinders with thin walls linked to one another, manufactured of one or more materials with high proportion of solidity and density specified in notes to items 2.5.2.1.1-2.5.2.1.1.5.

The cylinders are connected with the help of flexible rings specified in item 2.5.2.1.1.3. The assembled rotor has an internal closure and end items specified in items 2.5.2.1.1.4 and 2.5.2.1.1.5. However the complete assembly may be presented to the contractor partially assembled. Such type of supply shall also be subject to exports control

2.5.2.1.1.2. Rotor tubes 84012000

Specially designed or prepared thin wall cylinders with the width of the wall totaling 12mm (0.5 inches) or less, the diameter ranging from 75mm (3 inches) up to 400mm (16 inches), manufactured of one or more materials with high proportion of solidity and density specified in notes to items

2.5.2.1.1.-2.5.2.1.1.5.

2.5.2.1.1.3. Rings or sylphones 8307;

Components specially designed or prepared for creating local support for the rotor tube or connection of a number of rotor tubes. Sylphones are short cylinders with the wall width totaling 3mm (0,125 inches) or less, diameter ranging from 75mm (3 inches) up to 400mm (16 inches) that have one gofer and manufactured of one of materials with high proportion of solidity and density specified in notes to items 2.5.2.1.1.-2.5.2.1.1.5. 84012000

2.5.2.1.1.4. Closures 84012000

Specially designed or prepared components in the form of disk with diameter ranging from 75mm up to 400mm (from 3 inches up to 16 inches) for installing a centrifuge inside the rotor tube in order to isolate the discharge chamber from the main separation chamber and in particular cases for improving circulation of UF6 gas inside the main separation chamber of the rotor chamber and manufactured of one of materials with high proportion of solidity and density specified in notes to items 2.5.2.1.1-2.5.2.1.1.5.

2.5.2.1.1.5. Upper/lower lids 84012000

Specially designed or prepared components in the form of disk with diameter ranging from 75mm up to 400mm (from 3 inches up to 16 inches) for fitting precisely the diameter of the rotor tube ends and confining UF6 inside it. These components are used to support, hold and contain elements of upper bearing (upper lid) or serve as supporting part of revolving elements of the lower bearing (lower lid) and are manufactured of one of materials with high proportion of solidity and density specified in notes to items 2.5.2.1.1-2.5.2.1.1.5

Notes:

(to items 2.5.2.1.1.-2.5.2.1.1.5)

The following materials are used for revolving components of centrifuges:

a) aging martensite steels with the maximal solidity limit when broken 2.05x109 N/sq. meter (300000 pounds per sq. inch) or more;

b) aluminum alloys with the maximal solidity limit when broken 0.46x109 N/sq.meter (67000 pounds per sq.inch) or more;

c) fibrous materials that may be used in composite structures with the specific modulus totaling 12.3x106m or more and the maximal specific solidity limit when broken - 0.3x106m or more (the specific modulus is Young's modulus divided by the specific weight in N/cub. meters; "maximal specific solidity limit when broken" - is maximal solidity limit when broken in N/sq.meters divided by the specific weight in N/cub. meters)

2.5.2.1.2. Static components

2.5.2.1.2.1. Bearings with magnetic suspension 84833090

Specially designed or prepared bearing items consisting of circular magnet suspended in the form of clip containing vaporizing environment. The clip is manufactured of the proof material to UF6 (see the note). The magnet is connected with the polar point or second magnet installed on the upper lid specified in item 2.5.2.1.1.5. The magnet may be ring-shaped with the proportion of the external and internal diameters less or equal to 1.6:1 and the form providing:

a) starting penetration 0.15 Gn/meter (120000 SGS units) or more or

b) remaining magnetization totaling 98.5% or more or

c) product of induction and the maximal field tensity exceeding 80 kJ/cub. meter (107 Gs.A)

In addition to the ordinary features of material, limitation of divergence of magnetic axis from geometrical axis to small portions and ensuring special homogeneity of the magnet material

Note: Proof materials to UF6 include stainless steel, aluminum, aluminum alloys, nickel and alloys containing 60% of nickel and more

2.5.2.1.2.2. Bearings/vaporizers 848330900

Specially designed or prepared bearings containing axis/compacting ring attached to the vaporizer. Usually, the axis is shaped as a shaft made of tempered steel with one end shaped as semisphere and means of connection to the lower lid specified in item 2.5.2.1.1.5 on the other. However, the shaft may be connected with the hydrodynamic bearing. The ring is tablet-shaped with a semisphere niche on one surface. These components may be delivered separately from the vaporizer. Such deliveries shall also be subject to exports control.

2.5.2.1.2.3. Molecular pumps 841410300

Specially designed and prepared cylinders with small spiral ditch honed or pressed and holes drilled inside. The following are typical dimensions: internal diameter ranging from 75mm to 400mm (from 3 inches up to 16 inches), width of the wall 10mm (0.4 inches) or more, length equal to diameter or more. The ditches usually have rectangular cross-section and depth totaling 2mm or (0.08 inches) or more

2.5.2.1.2.4. Engine stators 850300990

Specially designed or prepared ring-shaped stators for high speed multi-phase alternating current hysteresis (or jet) electric motor for simultaneous work in vacuum condition with the frequency totaling 600-2000 Hz and with capacity ranging 50-1000 Va. Stators consist of multi-phase windings on a multi-layer iron core with low loss composed of thin plates with the usual width totaling 2.0mm (0.08 inches) or less

2.5.2.1.2.5. Centrifuge vessels/receivers 840120000

Components specially designed or prepared for placing in them an assembly of gas centrifuge rotor tube. The vessel consists of a hard cylinder with the wall width of up to 30mm (1.2 inches) with precisely shaped ends for installing bearings, with one or several flanges for mounting purposes. The shaped ends are parallel with each other and perpendicular to the longitudinal axis of the cylinder within 0.05 degrees or less. The vessel may also be formed as a celled type construction for placing several rotor tubes in it. The vessels are made from corrosion-proof material to UF6 or protected by coated with such materials

2.5.2.1.2.6. Traps 840120000

Specially designed or prepared tubes with the internal diameter of up to 12 mm (0,5 inch) for removal UF6 gas from the rotor tube according to Pito tube method (i.e. with a hole directed to the circular flow of gas in the rotor tube, for example via folding an end of the radially positioned tube), that may be attached to the central gas extraction system. Tubes are manufactured from corrosion-proof material to UF6 or protected with a coating of such materials

2.5.2.2. Specially designed or prepared auxiliary systems, equipment amd components for the use in the centrifugal enrichment facility:

Note:

Auxiliary systems, equipment and components of the centrifugal enrichment facility are formed as installment systems which are necessary to feed UF6 in centrifuges, for connection of separate centrifuges in order to create cascades (or stages) for reaching the highest concentration and extracting and recovering tailings UF6 of centrifuges, as well as equipment necessary for setting centrifuges into operation or for management of installment systems. Usually UF6 evaporates from solid substances placed inside heated autoclaves and are supplied in the form of gas to the centrifuges through the system of collector cascade pipelines. The "product" and "tailings" UF6 flowing from the centrifuges in the form of gas flows pass the cascade collector pipeline system to the cooled traps (operating with the temperature of about 203K (-70°C) where they are condensed and then placed in proper containers for transportation or storage. Due to the fact that the enrichment facility consists of many thousands of centrifuges put together into cascades, cascade collector pipelines that stretch for many kilometers are thus being created. They have thousands of welded stitches and the scheme of the major part of their connection is repeated many times. Equipment, components and pipeline systems are manufactured according to strict requirements set to vacuum density and processing purity

2.5.2.2.1. Delivering systems/systems of "product" and "tailings" 840120000

Specially designed or prepared technological systems that include:

2.5.2.2.1.1. Feeding autoclaves (or stations) used for feed of UF6 into centrifugal cascades with the pressure totaling up to 100 kPa (15 pounds per square inch) and with the speed of 1 kg per hrs. or more, fully manufactured of materials resistant to UF6 or protected with coating made of them in compliance with the strict requirements set to the vacuum density and processing purity 841989900

2.5.2.2.1.2. Desublimators (or cold traps) used for separation UF6 from cascades with the pressure totaling up tp 3 kPa (0.5 pounds per square inch), fully manufactured of materials resistant to UF6 or protected by coating made of them according to the strict requirements set to vacuum density and processing purity. Desublimators may be cooled to 203 K (-70°C) and heated to 343 K (70°C) 841989900

2.5.2.2.1.3. "Product" and "tail" stations used for removal UF6 in containers, equipment and pipelines that are fully manufactured of materials resistant to UF6 and protected by coating made of them according to the strict requirements set to vacuum density and processing purity 841989900

2.5.2.2.2. Collector pipelines machine systems

Specially designed or prepared systems of collectors and pipelines for containment of UF6 inside centrifugal cascades. This net of pipelines is usually formed as a system of with "triple" collector with each centrifuge linked to each collector. 840120000

Hence, the scheme of the major part of their connection is repeated many times. It is fully manufactured from UF6-proof materials according to the strict requirements set to vacuum density and processing purity

2.5.2.2.3. Mass spectrometers/ionizing sources for UF6

Specially designed or prepared magnet or quadrupole mass spectrometers capable of accomplishing direct selection of tests of the supplied mass of "product" or "tails" from UF6 gas flow and possessing the following characteristics: 902780990

1) specific mass resolution capability exceeds 320;
2) contains ionizing sources manufactured of nichrome or monel or protected with a coating made of them or nickeled;
3) contain ionizing sources with electron bombardment;
4) contain a collector system applicable for isotopic analysis

2.5.2.2.4. Frequency converters 850230990

Specially designed or prepared frequency converters (also known as converters or inverters) for feeding motor stators, as specified in item 2.5.2.1.2.4., or parts, components and subassemblies of such frequency converters possessing the following characteristics: 850440990

1) multi-phase output with the frequency ranging from 600 to 2000 Hz;
2) high stability (with frequency stabilization better than 0.1%);
3) low non-linear distortions (less than 2%);

4) efficiency more than 80%

Note:
(to items 2.5.2.2.-2.5.2.2.4.)
Equipment specified in items 2.5.2.2-2.5.2.2.4 comes into direct contact with technological gas UF6 or immediately controls operations of centrifuges and passage of gas from one centrifuge to another and from one cascade to another

Note:
(to items 2.5.2.2.1.-2.5.2.2.1.3.; 2.5.2.2) UF6-proof materials include stainless steel, aluminum, aluminum alloys, nickel and alloys containing 60% of nickel or more

2.5.2.3. Specially designed or prepared assemblies and components for the use in gaseous diffusion enrichment:

Note:
When applying gaseous diffusion method of uranium isotope asseparation, the major technological assembly is the special porous gaseous diffusion barrier, heat exchanger for gas cooling (which is heated in the course of compression process), compacting valves and regulating valves as well as pipelines. Since the gaseous diffusion technology uses the uranium hexafluoride (UF6), all equipment, pipelines and surfaces of measuring devices (that come into contact with gas) are manufacture of materials maintaining stability during contact with UF6. Gaseous diffusion facility consists of a number of such assemblies, so their quantity may be an important indicator of the final application

2.5.2.3.1. Gaseous diffusion barriers	
2.5.2.3.1.1. Specially designed or prepared thin porous filters with the size of pores totaling 100-1000 angstroms, width totaling 5mm (0.2 inches) or less and with regard to tube forms - with the diameter of 25mm (1 inch) or less, made of metallic, polymer or ceramic materials that are resistant to corrosion set up UF6	840120000 842139990
2.5.2.3.1.2. Specially prepared combinations or powders for producing the filters specified in item 2.5.2.3.1.1., with the size of particles totaling less than 10 mkm and high homogeneity with regard to their largeness, that are specially prepared for gaseous diffusion barriers made of:	
2.5.2.3.1.2.1. nickel or alloys containing 60% of nickel and more;	750400000
2.5.2.3.1.2.2. aluminum oxide	281820000
2.5.2.3.1.2.3. UF6-proof and full fluorine impact carbon polymers with purity totaling 99.9% or more	290330100
2.5.2.3.2. Diffusor chambers Specially designed or prepared hermetic cylinder vessels with the diameter totaling more than 300mm (12 inches) and the length totaling more than 900 mm (25 inches) or rectangular vessels of comparable sizes with one admission nipple and two discharge nipples, with the diameter of each of them totaling more than 50mm (2 inches)	731010000; 750800900; 7611 7612

for placing in them gaseous diffusion barriers manufactured from UF6-proof materials or coated with these materials and designed for vertical or horizontal installation

2.5.2.3.3. Compressors and blowers — 841480 (except for 841480100

Specially designed or prepared (axis, centrifugal or volume compressors or blowers with the output capacity totaling 1 cubic meters per minute or more than UF6 and with the discharge pressure up to several hundreds kPa (100 pounds per square inch) designed for lasting using in UF6 media with electric motor of the proper capacity or without it as well as separate assemblies of such compressors and blowers. These compressors and blowers have pressure fluctuations ranging from 2:1 to 6:1 and are made of UF6-proof materials or are coated with them.

2.5.2.3.4. Compacting of rotoring shafts — 848410900, 848490900

Specially designed or prepared vacuum seals installed on the delivering and the discharge side of the output for shaft compacting that links the rotor of compressor or blower with driving motor in order to provide reliable airtightness preventing air inflow into internal chamber of compressor or blower which filled of UF6. Such seals are usually projected factoring in the speed of buffer gas surge totaling less than 1000 cubic sm. per miniute (60 cubic inches per min.) — 848590900

2.5.2.3.5. Heat exchangers for cooling of UF6 — 841950900

Specially designed or prepared heat exchangers made of UF6-proof materials or coated with them (with the exception of stainless steel) or copper or any combination of these metals designed for the speed of alteration of pressure determining the leak totaling less than 10 Pa (0.0015 pounds per sq. inch) per hrs. with the pressure fluctuation equal to 100 kPa (15 pounds per sq. inch)

2.5.2.4. Specially designed or prepared auxiliary systems, equipment and components for the use in gaseous diffusion enrichment:

Notes:

Auxiliary systems, equipment and components for gaseous diffusion enrichment facilities are installment systems necessary for delivering UF6 into gaseous diffusion assembly, for connecting separate assemblies and creating cascades (or stages) in order to gradually achieve a higher level of enrichment and extraction of "product" and removal of "tailings" UF6 from diffusion cascades.

Due to inertion characteristics of diffusion cascades any interruption of their operation and specially halt may cause serious consequences. Hence, strict and constant vacuum maintenance in all technological systems has a paramount importance at the gaseous diffusion facility as well as automatic breakdown protection and precise automatic gas flow regulation.

All of these factors lead to the necessity to mount on the facility a large number of measuring, regulating and controlling systems. Usually UF6 evaporates from the cylinders positioned inside autoclaves and delivered in the form of gas to the discharge points through the system of cascade collector pipelines.

"Product" and "tailings" UF6 inflowing from the discharge points in the form of gas flows, pass the system of cascade collector pipelines directed toward either cold traps or to compressors where gaseous flow UF6 is liquified and then placed in proper containers for transportation or storage. Since the gaseous diffusion enrichment facility has a large number of gaseous diffusion assemblies gathered in cascades, cascade collector pipelines stretching for many thousands kilometers with thousands of welded stitches are thus created and the scheme of the main part is repeated many times. Equipment, components and pipeline systems are made according to the strict requirements set to vacuum density and processing purity

2.5.2.4.1. Delivering systems/discharge systems for "product" and "tailings" 840120000

Specially designed or prepared technological systems capable of operating under pressure totaling 300kPa (45 pounds per sq. inch) or less including:

2.5.2.4.1.1. Feeding autoclave (or systems), used for feed UF6 in gaseous diffusion cascades 841989900

2.5.2.4.1.2. Desublimators (or cold traps), used for removal of UF6 from gaseous diffusion cascades 841989900

2.5.2.4.1.3. Liquefying station where UF6 in the form of gas from cascade is compressed and cooled to liquid state 841989900

2.5.2.4.1.4. "Product" and "tails" stations used for filling of containers by UF6 841989900

2.5.2.4.2. Collector pipeline systems 840120000

Specially designed or prepared pipeline systems and collectors systems for keeping UF6 inside gaseous diffusion cascades. This network of pipelines is a system with "dual" collector with each sell connected to each collector

2.5.2.4.3. Vacuum systems:

2.5.2.4.3.1. Specially designed or prepared large vacuum mains, vacuum collectors and vacuum pumps with productivity of 5 cub. meters per min. (175 cub. feet per minute) or more 840120000

2.5.2.4.3.2. Vacuum pumps specially designed or prepared for operating in atmosphere contained UF6 and made of aluminum, nickel or alloys containing more than 60% of nickel or coated with them. These pumps may rotational or reciprocating, have dislodging and carbon fluorine seals as well as may contain special operational liquid substances 841410300 841410500 841410900

2.5.2.4.4. Stopper and regulation valves 848110 848130910 848130990 848180

Specially designed or prepared manual or automatic stopper and regulation valves of sylphone type, made from UF6-proof materials with the diameter ranging from 40 to 1500 mm (from 1.5 to 59 inches) for installing in major and auxiliary systems gaseous diffusion enrichment facilities

2.5.2.4.5. Mass spectrometers/ionizing sources for UF6

Specially designed or prepared magnetic or quadrupole mass spectrometers, capable of accomplishing direct selection of tests of the delivered mass of product or tails from UF6 gaseous flow and which possesses the following characteristics:

1) specific mass resolution capacity over 320; 902780990
2) contain ionizing sources made of nichrom or monel or protected with a coating made of them or nickeled;
3) contain ionizing sources with electron bombardment;
4) contain a collector system that may be used for isotopic analysis

Note:

(to items 2.5.2.4.1.-2.5.2.4.5)

Equipment specified in items 2.5.2.4.1-2.5.2.4.5 comes into immediate contact with technological UF6 gas or directly regulates the flow within a cascade. All surfaces that contact with the technological gas fully made from UF6-proof materials or are coated with them.

For the purpose of separation that is related to gaseous diffusion facilities, materials resistant to corrosion set up UF6, include stainless steel, aluminum, aluminum alloys, aluminum oxide, nickel and alloys containing 60% of nickel and more, and also UF6-proof carbon polymers with full fluorine impact

2.5.2.5. Specially designed or prepared systems, equipment and components for the use in aerodynamic enrichment facilities:

Notes:

In the aerodynamic enrichment processes UF6 gaseous mixture and light gas (hydrogen or helium) are compressed and then driven through separating elements in which the isotopic separation is completed via gaining vast centrifugal forces with regard to geometry of a curvilinear wall.

There are two processes of type that were successfully developed: process of nozzle separation and the process of vortex tube.

For both processes the main components of cascade separation are cylindrical vessels in which special separation elements are placed (nozzles or vortex tubes), gas compressors and heat exchangers for removing the heat emerged in the course of compression. A number of such cascades is required for aerodynamic facilities so their number may serve as an important indicator of the final use.

Since in aerodynamic process UF6 is used, surfaces of all equipment, pipelines and measuring devices (that contact the gas) shall be made from materials which are resistant to UF6

Note:

(to items 2.5.2.5.1.-2.5.2.5.12)

Elements specified in items 2.5.2.5.1-2.5.2.5.12 directly contact UF6 technological gas or immediately regulate the flow within a cascade. All surfaces contacting the technological gas are completely made of UF6-proof materials or protected with a coating made of these materials.

For the purposes of points related to aerodynamic enrichment elements, materials, corrosion resistant to UF6, include copper, stainless steel, aluminum, aluminum alloys, nickel and alloys containing 60% of nickel and more, and also UF6-proof carbon polymers with fluorine impact

2.5.2.5.1. Separation nozzles and their assemblies 840120000

Specially designed or prepared separation nozzles consisting of gash-shaped curved channels with the curve radius less than 1mm (usually from 0.1 to 0.05 mm), corrosion-proof to UF6 and having internal cutting edge that separated the gas flowing thorough the nozzle into two factions

2.5.2.5.2. Vortex tubes and their assemblies 840120000

Specially designed or prepared vortex tubes cylinder or cone-shaped made of materials (corrosion resistant to UF6) or protected with a coating of these materials with the diameter ranging from 0.5 to 45 sm. with the proportion of length and the diameter totaling 20:1 or less as well as one or more tangential input hole. The tubes may be equipped with removal devices of nozzle type on one or both ends

Note:

The feeding gas is delivered into the vortex tube along a tangent from one end or through crooked blades or through multiple tangential input holes along the tube

2.5.2.5.3. Compressors and blowers 841480

Specially designed or prepared axis centrifugal compressors or blowers or compressors and blowers with positive displacement made of corrosion-proof to UF6 materials or protected with a coating of these materials with the output productivity totaling 2 cubic m per min. or UF6 mixture and light gas (hydrogen or helium)

Notes:

Compressors and blowers specified in item 2.5.2.5.3 usually have pressure fluctuation ranging from 1.2:1 to 6:1

2.5.2.5.4. Seals of rotoring shafts 848410900

Specially designed or prepared seals of rotoring shafts installed on the delivering and on the discharge side for compacting the shaft linking the compressor rotor or blower rotor to the driving motor in order to provide reliable airtightness preventing leaks of technological gas or inflow of air or compacting gas into the inner chamber of compressor or blower which is filled by UF6 mixture or the light gas 848490900 848590900

2.5.2.5.5. Heat exchangers for gas cooling 841950900

Specially designed or prepared heat exchangers made of corrosion resistant to UF6 materials or protected with a coating made of these materials

2.5.2.5.6. Jackets of separation elements 840120000

Specially designed or prepared jackets made of corrosion resistant to UF6 materials or protected with a coating made of these materials for placing in them vortex tubes or separation nozzles

Notes:

Jackets specified in item 2.5.2.5.6 are formed as cylinder-shaped chambers with the diameter totaling more than 300 mm and the length more than 900 mm or rectangular chambers of comparable sizes and may be used for verical and horizontal installation

2.5.2.5.7. Delivering systems/discharge systems of "product" 841989900 and "tails"

Specially designed or prepared technological systems or equipment for enrichment facilities made of corrosion resistant to UF6 materials or protected with a coating made of these materials including:

2.5.2.5.7.1. Feeding autoclaves, furnaces or systems, used for feed of UF6 for the enrichment process 841989900

2.5.2.5.7.2. Desublimators (or cold traps) used for removal of heated UF6 from the enrichment process for the further transfer 841989900

2.5.2.5.7.3. Liquefying and hardening stations used for removal of UF6 from the enrichment process by way compressing and transferring UF6 into solid or liquified form 841989900

2.5.2.5.7.4. Product and tails stations used for transferring UF6 into containers 841989900

2.5.2.5.8. Collector pipeline systems 840120000

Specially designed or prepared collector pipeline systems, made of corrosion resistant to UF6 materials or protected with a coating made of these materials for keeping UF6 inside aerodynamic cascades. This network of pipelines is a system with a "dual" collector with each cascade or a group of cascades linked to each collector

2.5.2.5.9. Vacuum systems and pumps:

2.5.2.5.9.1. Specially designed or prepared vacuum systems with the input capacity totaling 5 cub. meters per min. or more, consisting of vacuum mains, vacuum collectors and vacuum pumps and applying for work in UF6 gas environments 840120000

2.5.2.5.9.2. Specially designed or prepared vacuum pumps for operation in UF6 gas environments and made of corrosion resistant to UF6 materials or protected with a coating of these materials. Carbon sells with fluorine impact and special operational liquid substances may be used in these pumps 841410300 841410500 841410900

2.5.2.5.10. Special stopper and regulating valves 848110 848130910 848130990 848180

Specially designed or prepared manual or automatic stopper and regulating valves of sylphone type made of corrosion resistant to UF6 materials or protected with a coating made of these materials with the diameter ranging from 40 to 1500 mm for mounting in major and auxiliary systems of aerodynamic enrichment facilities

2.5.2.5.11. Mass spectrometers/ionizing sources for UF6 902780990

Specially designed or prepared magnetic or quadrupole mass spectrometers capable of accomplishing direct selection of tests of the delivered mass of "product" or "tails" of UF6 gas flows and possessing the following characteristics:

1) specific mass resolution capacity over 320;
2) contain ionizing sources made of nichrom or monel or protected with a coating made of them or nickeled;
3) contain ionizing sources with electron bombardment;
4) contain a collector system that may be used for isotopic analysis

2.5.2.5.12. Systems separated UF6 from light gas
Specially designed or prepared systems for separating UF6 from light gas (hydrogen, helium)

Notes:

Systems specified in item 2.5.2.5.12 are designed for reducing contain of UF6 in light gas to one part per million or less and include such equipment as:

a) cryogenic heat exchangers and cryogenic separators capable of creating temperature totaling -120°C or less or

b) cryogenic cooling blocks capable of creating temperature totaling -120°C or less or

c) separation nozzle blocks or vortex for removal of UF6 from light gas or

d) cold cathers for UF6, capable of creating temperature totaling -20°C or less

2.5.2.6. Specially designed or prepared systems, equipment and components for the use at chemical exchange facilities or at ion exchange enrichment facilities:

Notes:

Insignificant difference in mass observed in uranium isotopes leads to small changes in the balance of chemical reactions that may be used as a basis for isotope separation. There are two successfully develops processes: liquid chemical exchange and solid-liquid ionic exchange In the course of liquid chemical exchange an interaction of nonmixed liquid phases (water or organic) occurs which results in the effect of cascading thousands of separation stages. The water phase consists of uranium chloride placed in a solution of hydrochloric acid; the organic phase consists of extragent containing uranium chloride in organic solvent.

The contact filters in the separation cascade may be presented by liquid exchange columns (such as impulse columns with meshed plates) or liquid centrifugal contact filters. In order to provide reflux on each end, chemical conversions (oxidation and restoration) are necessary on both ends. The major objective of the construction is to prevent contamination of technological flows with some metal ions. In this regard plastic, coated with plastic (including application of hydrocarbon polymers with fluorine impact) and or coated with glass columns and pipelines are used.

In the solid-liquid ionic exchange process enrichment is achieved via uranium adsorption/dissorption on a special ultra-active ionic exchange resin or adsorbent.

The solution of uranium in hydrochloric acid and other chemical reactive substances are passed through cylinder-shaped enrichment columns containing compacted layers of adsorbent.

In order to constantly maintain the process it is necessary that a reflux system be present in order to separate uranium from the adsorbent and direct it back to the liquid flow so that it could be possible to collect the "product" and "tails". This may be reached by using the proper chemical reactive substances for restoration/oxidation which fully regenerate in separate external hoops and which may partially regenerate in the isotopic separation columns.

Presence of hot concentrated solutions of hydrochloric acid in the process requires that the equipment be made of special corrosion resistant materials or protected with a coating made of these materials

2.5.2.6.1. Liquid exchange columns (chemical exchange) 840120000
Specially designed or prepared counter-current liquid exchange columns with mechanical power input (i.e.

impulse columns with meshed plates, columns with plates moving back and forth and columns with internal turbine blenders) for uranium enrichment via chemical exchange process. In order to be corrosion resistant to concentrated solutions of hydrochloric acid, these columns and their internal components are made of the proper plastic materials (such as hydrocarbon polymers with fluorine impact) or glass or protected with a coating made of these materials. Columns are designed for a short passage time in the cascade (30sec or less)

2.5.2.6.2. Centrifugal liquid contact filters (chemical exchange) 840120000

Specially designed or prepared centrifugal liquid contact filters for uranium enrichment via the chemical exchange process. Rotation is used in these filters for obtaining liquid flows and then centrifugal power for the phase separation. In order to maintain corrosion resistance to concentrated hydrochloric acid contact filters are made of the proper plastic materials (such as hydrocarbon polymers with fluorine impact) or coated with them or glass. The centrifugal contact filters are designed for a short passing time in the cascade (30 sec. or less)

2.5.2.6.3. Systems and equipment for uranium restoration (chemical exchange)

2.5.2.6.3.1. Specially designed or prepared electric chemical restoration cells for uranium restoration from one valence state into another for uranium enrichment by means of using chemical exchange process. Materials of cells that contact technological solution must be corrosion resistant to concentrated hydrocarbon acid 840120000

Note:

The cathode compartment of the cell must be designed to prevent a secondary uranium oxidation to a higher valence state. In order to preserve uranium in the cathode compartment, the cell must have an impenetrable diaphragm membrane made of special cathode exchange material.

The cathode consists of the proper solid conductor such as graphite

2.5.2.6.3.2. Specially designed or prepared systems for extracting U+4 from the organic flow, for regulating the concentration of acid and for filling electric chemical restoration cells at the cascade capacity output

Note:

These systems consist of equipment of solvent extraction for extracting U+4 from the organic flow into liquid solution, vaporization equipment and (or) other equipment for achieving regulation and control of the hydrogen indicator and pumps or other transfer devices for filling electric chemical restoration cells. The major objective of this construction is to avoid contamination of the liquid flow by ions of some metals.

Hence the components of the equipment that contact the technological flow are made of the proper materials (such as glass, hydrocarbon polymers with fluorine impact, polyphinyl sulphate, polyether sulphone and resin imbued graphite) or protected with a coating of these materials

2.5.2.6.4. Feeding preparation systems (chemical exchange)

Specially designed or prepared systems for producing feeding solutions of high purity uranium chloride for chemical exchange facilities dealing with uranium isotope separation

Note:

Systems specified in item 2.5.2.6.4 consist of equipment for dissolution, solvent extraction and (or) ionic exchange equipment for refining as well as electrolytic cells for restoration of U+6 or U+4 into U+3. These systems produce uranium chloride solutions which contain only several parts per million of metallic admixtures such as chrome, iron, vanadium, molybdenum and other dual valence elements, their cations or cations with higher valence.

Construction materials for the system elements in which highly pure U+3 is processed, includes glass, fluorine hydrocarbon polymers, graphite covered with polyvinyl sulphate or polyether sulphone plastic and imbued with resin

2.5.2.6.5. Uranium oxidation systems (chemical exchange)

Specially designed or prepared systems for oxidation of U+3 into U+4 for returning into the cascade of uranium isotope separation in the course of chemical exchange

Notes:

Systems specified in item 2.5.2.6.5 may include such elements as:

a) equipment for providing chloride and oxygen contact with water effluents from the equipment dealing with separation of isotopes and extraction of the emerged U+4 into the depleted organic flow, returning from the cascade production output;

b) equipment that separates water from hydrocarbon acid in order to introduce water and hydrocarbon acid into the process in the proper places

2.5.2.6.6. Highly reactive ionic exchange resins/absorbents (ionic exchange) 382390200 391400000

Specially designed or prepared highly reactive ionic exchange resins/absorbents for uranium enrichment via ionic exchange process including porous resins with macromeshed structure and (or) membrane structures in which chemical exchange active groups are limited with a coating on the surface of nonactive porous auxiliary structure and other composition structures in any acceptable form including fiber particles.

These ionic exchange resins/absorbents have diameters totaling 0.2 mm or less and must be chemically resistant to concentrated hydrocarbon acid and physically solid so that their characteristics could not worsen in exchange columns.

Resins/absorbents are specially designed for obtaining kinetics of extremely rapid uranium isotope exchange (duration of semi-exchange reaching less than 10 sec.) and are capable of operating with the temperature ranging from 100°C to 200°c

2.5.2.6.7. Ionic exchange columns (ionic exchange) 842129900

Specially designed or prepared cylinder-shaped columns with the diameter of more than 1000mm for preserving and maintaining the filled layers of ionic exchange resins/absorbents for uranium enrichment via ionic exchange process.

These columns are made of materials (such as titanium or hydrocarbon polymers with fluorine impact) resistant to corrosion caused by concentrated hydrocarbon acid or protected with a coating made of these materials and are capable of operating with the temperature ranging from 100°C up to 200°C and pressure exceeding 0.7 MPa (102 pounds per square inch)

2.5.2.6.8. Ionic exchange reflux systems (ionic exchange)

2.5.2.6.8.1. Specially designed or prepared systems of chemical or electric chemical restoration for regeneration of reactive substances of chemical restoration used in cascades of ionic exchange uranium enrichment

2.5.2.6.8.2. Specially designed or prepared systems of chemical and electric chemical oxidation for regeneration of reactive substances of chemical oxidation used in cascades of ionic exchange uranium enrichment

Notes:

In the course of ionic exchange trivalence titanium (Ti^{+3}) may be used instead of restoration cation and in this case the restoration system obtains Ti^{+3} via restoration of Ti^{+4}

Trivalence iron (Fe^{+3}) may be used in the capacity of oxidizer in the process and in this case the oxidation system will be produce Fe^{+3} via oxidation of Fe^{+2}

2.5.2.7. Specially designed or prepared systems, equipment and components for the use in laser enrichment facilities:

Notes:

Existing systems for enrichment processes involving lasers are divided into two categories: those with the operating environment in the form of atomic uranium and those with the operating environment in the form of vapors of uranium combination.

These categories are generally known as:

first category - laser separation of isotopes via atomic vapors method (ALVIS or SILVA);

second category - molecular method of laser isotope separation (MLIS or MOLIS) and chemical reaction via selective isotopic laser activation (CRISLA).

Systems, equipment and components for laser enrichment facilities include:

a) devices for supplying vapors of metallic uranium (for selective photoionization) or devices for supplying vapors of uranium combination (for photodissociation or chemical activation);

b) devices for collection of enriched and combined metallic uranium in the capacity of "product" and "tails" in the first category and devices for collection of decomposed combinations or combinations that departed from the reaction in the form of "product" and unprocessed material in the capacity of "tails" in the second category;

c) operational laser systems for selective perturbation of uranium-235 isotopes;

d) equipment for preparation of feeding and conversion of product.

Due to the complex character of spectroscopy of atoms and uranium combinations any of the available laser technologies may be required

Notes:

Many components specified in items 2.5.2.7-2.5.2.7.13 immediately contact vapors of metallic uranium or with the liquid substance or with technological gas consisted of UF_6 or UF_6 mixture and other gases. All surfaces that come into contact with uranium or UF6 which are fully made of corrosion resistant materials or protected with a coating made of them.

For the purpose of separation relevant for the equipment components dealing with laser enrichment, materials resistant to corrosion caused by vapors or liquid substances containing metallic uranium or uranium alloys, include graphite and tantalum coated with ittrium oxide; materials resistant to corrosion set up UF6 includes copper, stainless steel, aluminum, aluminum alloys, nickel and alloys containing 60% or more of nickel and resistant to UF6, hydrocarbon polymers fully exposed to fluorine impact

2.5.2.7.1. Uranium vaporization systems (ALVIS)

Specially designed or prepared systems of uranium vaporization which contain powerful linear and raster electric ray cannons with the transferred target capacity totaling more than 2.5 kWt per sm.

2.5.2.7.2. Systems for processing liquid metallic uranium (ALVIS)

Specially designed or prepared systems for processing liquid metal for processing molten uranium or uranium alloys consisting of crucibles and cooling equipment for crucibles

Note:

Crucibles and other components of this system that contact the molten uranium or uranium alloys are made of corrosion and thermal resistant materials or protected with a coating made of these materials.

Acceptable materials include tantalum coated with ittrium oxide, graphite, graphite coated with oxides of other rare earth elements (included in the List of equipment and materials with regard to which the Federal legislation stipulates a special procedure for export and import of equipment and materials of dual purpose and the proper technologies applied for nuclear purposes) or their combinations

2.5.2.7.3. Aggregates for collecting metallic uranium "product" and "tails"

Specially designed or prepared aggregates for collecting "product" and "tails" of metallic uranium in liquid or solid form 841989900

Notes:

Components for these aggregates are made of materials resistant to heat and corrosion caused by vapors of metallic uranium or liquid substance, or protected with a coating made of these materials (such as graphite coated with ittrium oxide or tantalum) ad may include pipelines, valves, carbines, "grooves", inputs, heat exchangers and collector plates for magnetic, electrostatic or other separation methods

2.5.2.5.7.4. Separation modulus jackets (ALVIS) 840120000

Specially designed or prepared cylinder-shaped or rectangular chambers for positioning in them the source of metallic uranium vapors, electric ray cannon and collectors of "product" and "tails"

Note:

These jackets have a large number of input holes for supplying electric feeding and water, windows for laser bunches, combinations of vacuum pumps as well as for diagnostics and control of measuring devices. They also have devices for opening and closing in order to provide maintenance of inner components

2.5.2.7.5. Supersonic expansion nozzles (MLIS)
Specially designed or prepared supersonic expansion nozzles for cooling UF6 mixtures and light gas up to 150 K and corrosion-proof to UF6 840120000

2.5.2.7.6. Collectors of pentafluorine uranium product (MLIS)
Specially designed or prepared solid product collector of pentafluorine UF5, consisting of a filter, impact or cyclone type collectors or their combinations and corrosion-proof to UF5/UF6 media 840120000

2.5.2.7.7. Compressors UF6/light gas (MLIS)
Specially designed or prepared compressors for mixtures UF6 and light gas for extensive exploitation in the UF6 environment. Components of these compressors which contact light gas, made from corrosion-proof materials to UF6 or protected with a coating made of these materials 841480 (except 841480100)

2.5.2.7.8. Seals of rotating shafts (MLIS) 848410900 848490900 848590900
Specially designed or prepared seals of rotating shafts installed on the delivering side and on the discharge side for compacting the shaft linking compressor rotor with the driving motor in order to provide hermetization preventing leaks of technological gas or inflow of air or compacting gas into the inner chamber of compressor which is filled with a mixture of UF6 and light gas

2.5.2.7.9. Fluorine impact systems (MLIS) 840120000
Specially designed or prepared systems for fluorinating UF5 (in solid state) to UF6 (gas)

Notes:

Systems specified in item 2.5.2.7.9 designed for rendering fluorine impact of collected powder of UF5 upon UF6 for the further collection of product in containers or for transfer in the capacity of feeding to MLIS blocks for additional enrichment.

When applying one approach the reaction of fluorine impact may be completed within the limits of isotope separation system where the reaction and the direct extraction of "product" from collectors takes place.

When applying another approach the powder of UF5 may be extracted (transferred) from "product" collectors into the proper reactor (for example reactor with quasiliquified catalyst layer, helium cooled reactor or heat tower) for the purpose of fluorine impact. In both cases equipment for storage and transfer of fluorine (or other acceptable reactive substances with fluorine impact) may be used as well as for UF6

2.5.2.7.10. Mass spectrometers/ionizing sources UF6 (MLIS) 902780990
Specially designed or prepared magnetic or quadrupole mass spectrometers capable of accomplishing direct selection of tests of the delivered mass of "product" or "tailings" of gas flows UF6 and possessing the following characteristics:

1) specific mass resolution capability exceeds 320;

2) contains ionizing sources manufactured of nichrome or monel or protected with a coating made of them or nickeled;
3) contain ionizing sources with electron bombardment;
4) contain a collector system applicable for isotopic analysis

2.5.2.7.11. Delivering systems/discharge systems of "product" and "tails" (MLIS) 840120000

Specially designed or prepared technological systems or equipment for enrichment facilities made of corrosion-proof materials to UF6 or protected with a coating made of these materials including:

2.5.2.7.11.1. Feeding autoclaves, furnaces or systems which used for entering UF6 for enrichment process 848989900

2.5.2.7.11.2. Desublimators (or cold traps), used for separation of heated UF6 from the enrichment process for the further transport 841989900

2.5.2.7.11.3. Hardening or liquefying stations, used for separation of UF6 from the enrichment process by way compressing and transferring of UF6 into liquid or solid form 841989900

2.5.2.7.11.4. Stations of "product" and "tails", used for removing of UF6 into containers 841989900

2.5.2.7.12. Separation systems for UF6 from light gas (MLIS)

Specially designed or prepared systems for separating UF6 from light gas.

The light gas may be represented by nitrogen, argon or other gas 841989900

Notes:

Systems specified in item 2.5.2.7.12 may include such equipment as:

a) cryogenic heat exchangers or cryogenic separators capable of creating temperatures totaling -120°C or less, or

b) cryogenic cooling blocks capable of creating temperatures totaling -120°C or less or

c) cold traps for UF6 capable of creating temperatures fluctuating around -20°C or less

2.5.2.7.13. Laser systems (ALVIS, MLIS, CRISLA)

Specially designed or prepared lasers and laser systems for uranium isotope separation 840120000 901320000

Notes:

When applying laser enrichment process laser and laser components are used. They are included in the List of equipment and materials with regard to which the Federal legislation stipulates a special import and export procedure for dual purpose equipment and materials and the proper technologies used for nuclear purposes.

The laser system of ALVIS process usually consists of two lasers: lasers operating with copper vapors and lasers operating with dye stuff. The laser system for M$IC usually consists of laser operating on CO2 or eximer laser and multimeshed optical cell with rotating mirrors on both sides.

Lasers and laser systems used in these processes require spectre frequency stabilizer for operating within a long period of time

2.5.2.8. Specially designed or prepared systems, equipment and components for application in enrichment facilities with plasm separation:

Note:

In the course of plasm separation, the plasm consisting of uranium ions passes electric field operating at the frequency of U235 ionic resonance so that it could consume energy in the first place and increase the diameter of their corkscrew-shaped orbits. Ions passing large diameter are captured for creating enriched U235 product.

Plasm created via ionizing uranium vapor is positioned in vacuum chamber with high intensity magnet field created with the help of a superconductor magnet. Major technological systems of this process include the uranium plasm generation system, separation modulus with a superconductor magnet included in the List of equipment and materials with regard to which the Federal legislation stipulates a special export and import procedure for dual purpose equipment and materials and the proper technologies used for nuclear purposes and systems of metal extraction for collection of "product" and "tails"

2.5.2.8.1. Microwave energy sources and antennas 854380900

Specially designed or prepared microwave energy sources and antennas for generating or accelerating ions that possess the following characteristics:

a) frequency over 30 GHz and

b) average output capacity for creating ions over 50kWt

2.5.2.8.2. Solenoids for ion perturbation 850450900

Specially designed or prepared solenoids for radio frequency ion perturbation with the frequency totaling more than 100 kHz that are capable of operating with average capacity exceeding 40 kWt

2.5.2.8.3. Systems for uranium plasm production 851580900

Specially designed or prepared systems for uranium plasm production that may contain powerful plate or raster electric ray cannons with the transferred target capacity exceeding 2.5 kWt per sm. 854310000

2.5.2.8.4. Systems for processing liquid metallic uranium

Specially designed or prepared systems for processing liquid metal for molten uranium or uranium alloys consisting of crucibles and cooling equipment for crucibles

Note:

Crucibles and other components of this system that contact the molten uranium or uranium alloys made of corrosion and thermal resistant materials or protected with a coating made of these materials. The acceptable materials include tantalum, graphite coated with ittrium oxide, graphite coated with other rare earth elements oxides (included in the List of equipment and materials with regard to which the Federal legislation stipulates a special procedure for export and import of equipment and materials of dual purpose and the proper technologies applied for nuclear purposes) or their mixtures

2.5.2.8.5. Aggregates for collection of metallic uranium "product" and "tails" 841989900

Specially designed or prepared aggregates for collection of metallic uranium "product" and "tails" in solid form. These aggregates for collection are made of materials resistant to heat and corrosion caused by vapors of metallic uranium such as graphite coated with ittrium oxide or tantalum or protected with a coating made of these materials

2.5.2.8.6. Jackets of separation modulus

Specially designed or prepared for the use in enrichment facilities with plasm separation cylinder-shaped chambers for positioning in them the uranium plasm source, energy radiofrequency solenoid and "product" and "tails" collectors 840120000

Note:

Jackets specified in item 2.5.2.8.6 have a large number of input holes for delivering electric feeding, combinations of diffusion pumps as well as for diagnostics and control of controlling and measuring devices. They have opening and closing devices to provide maintenance of internal components and are made of the proper nonmagnetic materials such as stainless steel

2.5.2.9. Specially designed or prepared systems, equipment and components for the use in electromagnetic enrichment facilities:

Notes:

In the course of electromagnetic process metallic uranium ions obtained via ionizing the feeding material from salts (usually USI4), are accelerated and pass the magnetic field which drives ions of different isotopes pass in various directions.

The major components of electromagnetic isotope separator are: magnetic field for deviation/separation of isotopes of ionic bunch, source of ions with its acceleration system and systems for collection of separate ions. Auxiliary systems applicable in the process include a system of magnetic energy supply, systems of high voltage ionic source feeding, vacuum system and inclusive chemical processing systems for restoration of product and refining/regenerating components

2.5.2.9.1. Specially designed or prepared systems for application at electromagnetic enrichment facilities

2.5.2.9.2. Specially designed or prepared equipment and components for application at electromagnetic enrichment facilities: 841120000

2.5.2.9.2.1. Specially designed or prepared for uranium isotope separation electromagnetic separators of isotopes and equipment and components including:

2.5.2.9.2.1.1. Specially designed or prepared particular or numerous sources of uranium ions consisting of the vapor source, ionizer and bunch accelerator made of the proper materials such as graphite, stainless steel or copper capable of preserving the general current in ionic bunch totaling 50mA or more 840120000

2.5.2.9.2.1.2. Ion collectors 854310000
Specially designed or prepared collector plates with two or more gashes and grooves for collecting ion bunches of enriched and depleted uranium, made of the proper materials such as graphite or stainless steel 840120000

2.5.2.9.2.1.3. Vacuum jackets 840120000
Specially designed or prepared vacuum jackets for electromagnetic uranium separators made of the proper nonmagnetic metals such as stainless steel or those designed for operations under the pressure of 0.1 Pa or less

Note:

Jackets specified in item 2.5.2.9.2.1.3 are specially designed for placing ionic sources in them as well as collector plates and water cooled bushes and have devices for connecting diffusion pumps as well as opening and closing devices for extracting and replacing these components

2.5.2.9.2.1.4. Magnetic polar point 850590100
Specially designed or prepared magnetic polar points with the diameter exceeding 2 meters used for maintaining constant magnetic field in the electromagnetic isotope separator and for transferring the magnetic field between separators closely positioned

2.5.2.9.2.2. High voltage power supply 850440990
Specially designed or prepared high voltage power supply for ionic sources possessing the following characteristics:

a) may operate in permanent mode;
b) output tension 20000 V or more;
c) output current totaling 1 A or more;
d) tension stabilization less than 0.01% within 8 hrs.

Decree of the President of the Russian Federation No. 468 of May 12, 1997 supplemented the Section with the Item 2.5.2.9.2.3.

2.5.2.9.2.3 Power supply sources for electromagnetes specially designed or prepared high-power d.c. power supply sources for electromagnets having all below characteristics: 850440990
a) output current in continuous mode 500 A or more at a voltage of 100 V or more;
b) current or voltage stabilization not worse than 0.01% during 8 hours;

Decree of the President of the Russian Federation No. 468 of May 12, 1997 reworded Item 2.6.
see the previous text of the Item

2.6. Plants for the production or concentration of heavy water, deuterium and deuterium combinations and specially designed or prepared equipment for them:

Notes:

Heavy water may be produced via different processes. However, there are two commercially profitable processes: the process of isotopic water exchange and hydrogen sulphite (process _C) and the process of isotopic exchange between ammonia and hydrogen. Process _C is based upon the exchange of hydrogen and deuterium between water and hydrogen sulphite in the column system, which are exploited with the upper section cooled and the lower section heated. The water flows down along columns while hydrogen sulphite gas circulates from the bottom to the top of columns. In order to foster blending of gas and water, a number of gutters with holes is used.

Deuterium is moved to the water under low temperature and in hydrogen sulphite under high temperature. Deuterium enriched gas or water are removed from the primary columns at the joint of heated and cooled sections and this process is repeated in columns of the next stage.

Product of the ultimate phase - water enriched by deuterium up to 30% is directed to distillation facility for producing reactor-pure heavy water, i.e. 99,75 deuterium oxide.

In the process of exchange between ammonia and hydrogen it is possible to extract deuterium from synthesis gas by means of contacting liquid ammonia with catalyst. Synthesis gas is supplied to exchange columns and then to ammonia converter. Inside the columns gas rises from the bottom to the top while the liquid ammonia flows from the top to the bottom. Deuterium is extracted from hydrogen contained in the synthesis gas and concentrated in ammonia. Thereafter, ammonia flows to ammonia cracking facility from the bottom of the column while the gas is concentrated in the ammonia converter in the upper part of the column. In the following stages further enrichment takes place and via eventual distillation reactor-pure heavy water is obtained.

The supply of synthesis gas is provided by the ammonia facility which in turn may be mounted along with a facility for heavy water production via isotopic exchange of ammonia and hydrogen. In the course of ammonia-hydrogen exchange ordinary water may also be used as a source of final deuterium. Many key equipment items for heavy water production facilities using processes _C or ammonia-hydrogen exchange are widely spread in certain branches of oil and chemical industry. Particularly, it applies to small facilities using process _C.

However, few equipment items are standard. Processes _C and ammonia-hydrogen exchange require processing of large amounts of inflammable, corrosive and toxic liquid substances under increased pressure. Subsequently, when developing standards of design and exploitation of facilities and equipment utilizing these processes, more attention is paid to selection of materials and their characteristics in order to ensure a more extensive service preserving high safety standards and reliability. Determination of scope is carried out from the perspective of economy and necessity.

Thus, the major part of equipment items is produced according to the requirements of the client. It is worth mentioning that both in process _C and in ammonia-hydrogen exchange process equipment items that are not designed or prepared specially for heavy water production may be assembled in systems specially designed or prepared for heavy water production. Fine examples of these systems applied in both processes are the catalyst cracking system used in the process of ammonia-hydrogen exchange and distillation systems used in the process of final concentration of heavy water that brings it to the reactor-pure state.

2.6.1. Facilities for producing heavy water, deuterium and deuterium combinations

2.6.2 Specially designed or prepared equipment for heavy water production either via the process of exchange between water and hydrogen sulphite or the process of exchange between ammonia and hydrogen:	840120000
2.6.2.1. Water and hydrogen sulphite exchange columns Specially designed or prepared exchange columns for heavy water production via the process of isotopic exchange between water and hydrogen sulphite, made of small-grained hydrocarbon steel with the diameter ranging from 6m (20 feet) to 9m (30 feet), which may be exploited under the pressure exceeding or equal to 2MPa (300 pounds per sq.inch) and have	840120000

corrosion room totaling 6mm or more

2.6.2.2. Blowers and compressors 841480

Specially designed or prepared single stage small headed (i.e. 0.2 MPa or 30 pounds per sq. inch) centrifugal blowers or compressors for heavy water production using the process of water and hydrogen sulphite exchange, for circulation of hydrosulphide gas (i.e. gas containing more than 70% of H2C) with the capacity exceeding or equal to 56 cub.m/sec (120000 CCFM) when exploited under the output pressure exceeding or equal to 1.8 MPa (260 pounds per sq. inch) with stuffing boxes resistant to H2C attached

2.6.2.3. Ammonia-hydrogen exchange columns 840120000

Specially designed or prepared ammonia-hydrogen exchange columns with the height equal to 35 m (114.3 feet), diameter ranging from 1.5 m (4.9 feet) up to 2.5 m (8.2 feet) for producing heavy water via exchange of hydrogen and ammonia, which may be exploited under the pressure exceeding 15 MPa (2225 pounds per sq.inch). These columns also have at least one flank axis hole of the same diameter as the cylinder part through which internal parts of the column may be attached or removed.

2.6.2.4. Internal parts of the column and stepped pumps 840120000

Specially designed or prepared internal parts of the column and stepped pumps for columns for heavy water production via ammonia-hydrogen exchange. 841370

Internal parts of the column include specially designed or prepared contractors between steps contributing to close contact of gas and the liquid substance.

Stepped pumps include specially designed pumps that are put in the liquid substance for the circulation of liquid ammonia within the limit of contractor volume located inside the steps of columns

2.6.2.5. Ammonia cracking facilities exploited under the pressure exceeding or equal to 3 MPa (450 pounds per sq. inch) specially designed or prepared for heavy water production via isotopic exchange of ammonia and hydrogen 840120000

2.6.2.6. Infrared consumption analyzers capable of analyzing proportion of hydrogen as opposed to deuterium in real time scope when deuterium concentration exceeds or equals 90% 902730000

2.6.2.7. Catalyst furnaces for processing enriched deuterium gas into heavy water, specially designed or prepared for heavy water production via isotopic exchange of uranium and hydrogen 840120000

Decree *of the President of the Russian Federation No. 468 of May 12, 1997 supplemented the Section with Item 2.6.2.8.*

2.6.2.8. Complete systems for the enrichment of heavy water 840120000

Specially designed or prepared complete systems for the enrichment of heavy water and the columns for the enrichment of heavy water up to the concentration of deuterium used in reactors

Note: Systems normally using water distillation to separate heavy and light water specially designed or prepared for the production of heavy water used in reactors (normally with the content of 99.75% of deuterium oxide) from the heavy water of lower concentration fed to them;

2.7 Specially designed or prepared systems for converting uranium 851430900

Notes:

Facilities and systems for uranium conversion may perform one or several conversions of one chemical uranium isotope into another including conversion of uranium ore concentrates into UO3, conversion of UO3 into UO2, conversion of uranium oxides into UF4 or UF6, conversion of UF4 into UF6, conversion of UF6 into UF4, conversion of UF4 into metallic uranium and conversion of uranium fluorine into UO2. Many key components of facility equipment for uranium conversion are characteristic for certain branches of chemical processing industry.

For example, types of equipment used in these processes may include furnaces, whirl furnaces, reactors with a quasi-liquified layer of catalyst, heat reactor towers, liquid substance centrifuge, distillation columns, and lignification extraction columns.

However, very few components of equipment have the "finished form" - many if them must be prepared according to requirements and specifications of the customer. In particular cases it is necessary to factor in special design and construction peculiarities for protection against aggressive features of some processing chemical substances (HF, F2 TslF3 and uranium fluorine). In all of the conversion processes of uranium equipment components that are not specially designed or prepared for uranium conversion may be assembled into systems specially designed or prepared for uranium conversion purposes

2.7.1. Specially designed or prepared systems for converting uranium concentrates into UO3

Note:

Conversion of uranium ore concentrates into UO3 may be carried out firstly via dissolution of ore in nitric acid and extraction of the refined uranium dinitrate hexahydrate with the help of such solvent as tributile phosphate. Then uranium dinitrate hexahydrate is converted into UO3 either via concentration and denitration or neutralization by gaseous ammonia for obtaining diuranic ammonium with the further filtering, drying and calcium impact.

2.7.2. Specially designed or prepared systems for conversion of UO3 into UF6 841989900

Note:

Conversion of UO3 into UF6 may be carried out directly via fluorine impact. This process requires a gaseous fluorine source or trifluorine chlorine

2.7.3. Specially designed or prepared systems for converting UO3 into UO2 841989900

Note:

Conversion of UO3 into UO2 may be carried out by restoring UO3 with gaseous cracking ammonia or hydrogen

2.7.4. Specially designed or prepared systems for conversion of UO2 into UF4 — 841989900

Note:

Conversion of UO2 into UF4 may be carried out via reaction of UO2 with gaseous hydrogen fluorine (HF) under the temperature 300-500°C

Decree *of the President of the Russian Federation No. 468 of May 12, 1997 replaced formula "UO4" with the formula "UF4" in Item 2.7.5 and attached Note*

2.7.5. Specially designed or prepared systems for conversion of UF4 into UF6 — 841989900

Note:

Conversion of UF4 into UF6 may be carried out via exothermic reaction with fluorine in reactor tower. UF6 is condensed from heated light gases by passing the gas flow through the cold trap cooled to -10°C. This process requires a gaseous fluorine source

2.7.6. Specially designed or prepared systems for conversion of UF4 into metallic uranium — 841989900

Note:

Conversion of UF4 in metallic uranium may be carried out by its restoration with magnesium (in large amounts) or calcium (small amounts). This reaction is carried out under the temperature exceeding the molting point of uranium (1130°C)

2.7.7. Specially designed or prepared systems for conversion of UF6 into UO2 — 841989900

Note:

Conversion of UF6 into UO2 may be carried out via one of the three processes. In the first one UF6 is restored and hydrolyzed into UO2 using hydrogen and steam. In the second one UF6 is hydrolyzed by dissolution in water for separation diuranic ammonium ammonia is added and diuranium is restored in UO2 by hydrogen under the temperature of 820°C.

In the third process gaseous UF6, CO2 and HH4 are mixed in water separating uranic ammonium carbonate. This substance is mixed with vapor and hydrogen under the temperature of 500-600°C for producing UO2.

Conversion of UF6 into UO2 is often carried out in the first stage of the fuel production facility

2.7.8. Specially designed or prepared systems for conversion of UF6 into UF4 — 841989900

Note:

Conversion of UF6 into UF4 may be carried out via restoration with hydrogen

2.8. Technologies related to all of the items included in Section 2 of this List

General Criteria for Transferring Technologies Related to Processing, Enrichment of Uranium, Heavy Water Production

1. The major determining components are:

1.1. With regard to gaseous centrifugal facility for isotope separation: gas centrifuges assemblies, corrosion resistant to UF_6;

1.2. With regard to gas diffusion facility for isotope separation: diffusion barriers;

1.3. With regard to nozzle facility for isotope separation: nozzle elements;

1.4. With regard to vortex facility for isotope separation: vortex elements.

2. For the facilities specified in items 2.3-2.7.8 for which in items 3.1-3.1.4 no key components are specified, when a considerable number of items significant for operation of such a facility is exported in one set along with "know-how" for construction and exploitation of this facility, such transfer shall be regarded as a transfer of "the facility or its major determining components".

3. In order to exercise control over the exports of sensible facilities, facilities of "the same type" (i.e. if their design, constructions or exploitation processes are based upon same or similar physical and chemical processes)" shall be considered the following facilities:

When the transferred technology makes it possible to create in the country of destination the following types of facilities or their major key components:

Facilities of the same type shall be considered the following facilities:

a) gas diffusion facility for isotope separation or any other facility for isotope separation involving gas diffusion process;

b) gaseous centrifugal facility for isotope separation or any other facility for isotope separation involving gaseous centrifugal process;

c) nozzle facility for isotope separation or any other facility for isotope separation involving nozzle process;

d) vortex facility for isotope separation or any other facility for isotope separation involving vortex process

e) facility for fuel processing involving extraction process or any other facility for fuel processing involving extraction process;

f) facility for heavy water production involving exchange process or any other facility for heavy water production involving exchange process;

g) facility for heavy water production involving electrolytic process or any other facility for heavy water production involving electrolytic process;

h) facility for heavy water production involving hydrogen distillation process or any other facility for heavy water production involving hydrogen distillation process

Note:

With regard to facilities for processing, enrichment, production of heavy water, design, construction or exploitation of which are based upon processes other than the physical and chemical processes listed above, a similar approach shall be applied for rendering definition of facilities "of the same type"; in this case a necessity of defining key components of these facilities may arise.

4. It is assumed that reference to any facilities of the same type built in the country of destination within the coordinated period of time, may apply to such facilities (or their major key components) that are primarily put into operation within a period of at least 20 years starting at the moment when they for the first time were put into operation:

1) facilities that were transferred or that includes or which includes major key components or

2) facilities of the same type built after the transfer of technology.

It is assumed that within this period it is acknowledged that any facility of the same type applies the transferred technology. But the coordinated period is not intended for limiting the term of guarantee validity or term for the right to specify facilities as facilities created or operating on the basis of or applying the transferred technology in conformity with the importer's obligation to ensure that the agreement on guarantees is valid permanently, which allows the IAEA to apply the Agency guarantees with regard to such facilities on which the transferred technologies are used.

Definition of Terms
(applicably for this List)

1. "Technology" - special information required for designing, producing and using any item included in the List. This information may be transferred in the form of "technical assistance" or "technical information".

Note:

This definition of technology does not apply to technology of "public ownership" or "fundamental scientific research"

2. "Technical assistance" may be rendered in such forms as:

training;

measures on advancing qualification;

practical training of personnel;

submission of working information;

consulting services.

"Technical assistance" may include transfer of "technical information".

3. "Technical information" may be rendered in such forms as:

drafts and their copies;

schemes;

diagrams;

models;

formulas;

technical projects and specifications;

reference materials;

manuals and instructions in the written form or recorded on other devices such as disk, magnetic tape, constant memory devices (CMD).

4. "Public ownership" applies to a technology granted with no restrictions of its further distribution. (Restrictions related to copyright shall not exclude the technology from the "public ownership" category).

5. "Fundamental scientific research" applies to experimental or theoretical works that are primarily conducted for obtaining new knowledge about the fundamental principles of fenomena and observed facts that do not primarily aim at achieving a concrete practical goal or solving a concrete task.

6. "Design" includes all production stages such as:

design;

design research;

analysis of project variants;

development of design concepts;

assembly and test of prototypes (test samples);

schemes of test production;

technical documentation;

process of implementation of project information in the product;

structural design;

complex design;

assembly scheme;

7. "Production" applies to all stages of production such as:

construction;

production technology;

manufacturing;

integration;

mounting (assembly);

control;

tests; measures on ensuring quality.

8. "Application" means exploitation, installation (including installation on site), maintenance (examination), current repairs, workover and modernization.

* The belonging of a specific good or technology to the goods and technologies subject to exports control shall be determined by the correspondence of the technical specifications of such a good or technology to the specifications set forth under this column.