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Atoms for Peace

Information Circular

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Communication Received from Certain Member States Regarding Guidelines for Transfers of Nuclear-related Dual-use Equipment, Material, Software and Related Technology

1. The Agency has received a Note Verbale from the Permanent Mission of Hungary, dated 14 June 2010, in which it requests that the Agency circulate to all Member States a letter of 7 May 2010 from the Chairman of the Nuclear Suppliers Group, Ambassador Ms. Györgyi Martin Zanathy, to the Director General, on behalf of the Governments of Argentina, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Kazakhstan, Republic of Korea, Latvia, Lithuania, Luxemburg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom of Great Britain and Northern Ireland and the United States of America,[1] providing further information on those Governments' Guidelines for Nuclear Transfers.

2. In the light of the wish expressed in the above-mentioned Note Verbale, the text of the Note Verbale, as well as the letter and attachments thereto, are hereby reproduced for the information of all Member States.

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[a] INFCIRC/254/Part 1, as amended, contains Guidelines for the export of nuclear material, equipment and technology.

[1] The European Commission participates as an observer.

PERMANENT MISSION OF THE REPUBLIC OF HUNGARY
TO THE UNITED NATIONS OFFICE AND OTHER
INTERNATIONAL ORGANIZATIONS IN VIENNA

Ref. No.: 39/2010

The Permanent Mission of the Republic of Hungary to the United Nations Office and Other International Organizations in Vienna avails itself of this opportunity to the IAEA the assurances of its highest consideration.

CHAIRMAN OF THE NUCLEAR SUPPLIERS GROUP

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In the interest of clarity, the complete text of the modified Guidelines and its Annexes is reproduced in the attachment, as well as a "Comparison Table of Changes to the Guidelines for Nuclear Transfers (INFCIRC/254/Rev.7/Part 2)."

These Governments have decided to act in accordance with the Guidelines so revised and to implement them in accordance with their respective national legislation.

In reaching this decision, these Governments are fully aware of the need to contribute to economic development while avoiding contributing in any way to a proliferation of nuclear weapons or other nuclear explosive devices or the diversion to acts of nuclear terrorism, and of the need to separate the issue of non-proliferation or non-diversion assurances from that of commercial competition.

Insofar as trade within the European Union is concerned, the Governments that are Member States of the European Union will implement this decision in the light of their commitments as Member States of the Union.

I would be grateful if you would bring this Note and its attachment, INFCIRC/254/Rev.8/Part 2 and the Comparison Table, to the attention of all Member States of the IAEA.

On behalf of the above Governments I wish to avail myself of this opportunity to renew to you the assurances of the Governments' highest consideration.

Yours sincerely,

H.E. Ms. Györgyi Martin Zanathy
Chairman of the Nuclear Suppliers Group

H.E. Mr. Yukiya AMANO
Director General
International Atomic Energy Agency
Vienna

GUIDELINES FOR TRANSFERS OF NUCLEAR-RELATED DUAL-USE EQUIPMENT, MATERIALS, SOFTWARE, AND RELATED TECHNOLOGY

OBJECTIVE

1. With the objective of averting the proliferation of nuclear weapons and preventing acts of nuclear terrorism, suppliers have had under consideration procedures in relation to the transfer of certain equipment, materials, software, and related technology that could make a major contribution to a “nuclear explosive activity,” an “unsafeguarded nuclear fuel-cycle activity” or acts of nuclear terrorism. In this connection, suppliers have agreed on the following principles, common definitions, and an export control list of equipment, materials, software, and related technology. The Guidelines are not designed to impede international co-operation as long as such co-operation will not contribute to a nuclear explosive activity, an unsafeguarded nuclear fuel-cycle activity or acts of nuclear terrorism. Suppliers intend to implement the Guidelines in accordance with national legislation and relevant international commitments.

BASIC PRINCIPLE

2. Suppliers should not authorize transfers of equipment, materials, software, or related technology identified in the Annex:

   - for use in a non-nuclear-weapon state in a nuclear explosive activity or an unsafeguarded nuclear fuel-cycle activity, or

   - in general, when there is an unacceptable risk of diversion to such an activity, or when the transfers are contrary to the objective of averting the proliferation of nuclear weapons, or

   - when there is an unacceptable risk of diversion to acts of nuclear terrorism.

EXPLANATION OF TERMS

3. (a) "Nuclear explosive activity" includes research on or development, design, manufacture, construction, testing or maintenance of any nuclear explosive device or components or subsystems of such a device.

   (b) "Unsafeguarded nuclear fuel-cycle activity" includes research on or development, design, manufacture, construction, operation or maintenance of any reactor, critical facility, conversion plant, fabrication plant, reprocessing plant, plant for the separation of isotopes of source or special fissionable material, or separate storage installation, where there is no obligation to accept International Atomic Energy Agency (IAEA) safeguards at the relevant facility or installation, existing or future, when it contains any source or special fissionable material; or of any heavy water production plant where there is no obligation to accept IAEA safeguards on any nuclear material produced by or used in connection with any heavy water produced therefrom; or where any such obligation is not met.

ESTABLISHMENT OF EXPORT LICENSING PROCEDURES

4. Suppliers should have in place legal measures to ensure the effective implementation of the Guidelines, including export licensing regulations, enforcement measures, and penalties for violations. In considering whether to authorize transfers, suppliers should exercise prudence in order to carry out the Basic Principle and should take relevant factors into account, including:

   (a) Whether the recipient state is a party to the Nuclear Non-Proliferation Treaty (NPT) or to the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco), or to a similar international legally-binding nuclear non-proliferation agreement, and has an IAEA safeguards agreement in force applicable to all its peaceful nuclear activities;

   (b) Whether any recipient state that is not party to the NPT, Treaty of Tlatelolco, or a similar international legally-binding nuclear non-proliferation agreement has any facilities or installations listed in paragraph 3(b) above that are operational or being designed or constructed that are not, or will not be, subject to IAEA safeguards;

   (c) Whether the equipment, materials, software, or related technology to be transferred is appropriate for the stated end-use and whether that stated end-use is appropriate for the end-user;

   (d) Whether the equipment, materials, software, or related technology to be transferred is to be used in research on or development, design, manufacture, construction, operation, or maintenance of any reprocessing or enrichment facility;

   (e) Whether governmental actions, statements, and policies of the recipient state are supportive of nuclear non-proliferation and whether the recipient state is in compliance with its international obligations in the field of non-proliferation;

   (f) Whether the recipients have been engaged in clandestine or illegal procurement activities; and

   (g) Whether a transfer has not been authorized to the end-user or whether the end-user has diverted for purposes inconsistent with the Guidelines any transfer previously authorized.

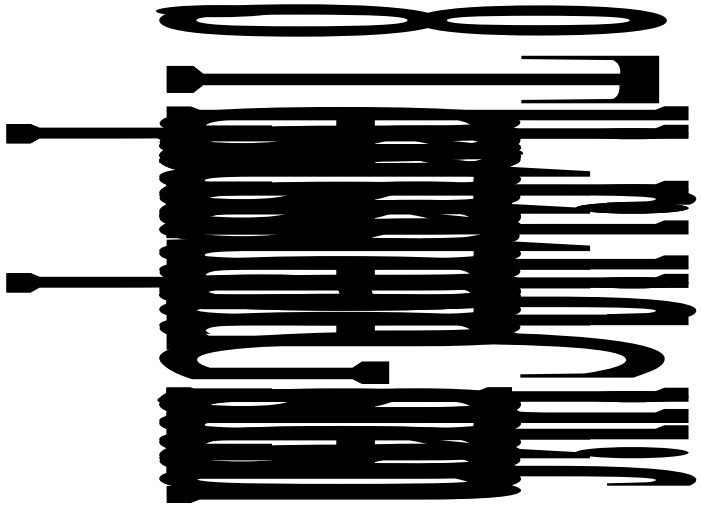
   (h) Whether there is reason to believe that there is a risk of diversion to acts of nuclear terrorism.

   (i) Whether there is a risk of retransfers of equipment, material, software, or related technology identified in the Annex or of transfers of any replica thereof contrary to the Basic Principle, as a result of a failure by the recipient State to develop and maintain appropriate, effective national export and transshipment controls, as identified by UNSC Resolution 1540.

5. Suppliers should ensure that their national legislation requires an authorisation for the transfer of items not listed in the Annex if the items in question are or may be intended, in their entirety or in part, for use in connection with a “nuclear explosive activity.”

   Suppliers will implement such an authorisation requirement in accordance with their domestic licensing practices.

   Suppliers are encouraged to share information on “catch all” denials.



ANNEX

LIST OF NUCLEAR-RELATED DUAL-USE EQUIPMENT, MATERIALS, SOFTWARE, AND RELATED TECHNOLOGY

ANNEX

Note: The International System of Units (SI) is used in this Annex. In all cases the physical quantity defined in SI units should be considered the official recommended control value. However, some machine tool parameters are given in their customary units, which are not SI.

Commonly used abbreviations (and their prefixes denoting size) in this Annex are as follows:

A --- ampere(s)
Bq --- becquerel(s)
°C --- degree(s) Celsius
CAS --- chemical abstracts service
Ci --- curie(s)
cm --- centimeter(s)
dB --- decibel(s)
dBm --- decibel referred to 1 milliwatt
g --- gram(s); also, acceleration of gravity (9.81 m/s2)
GBq --- gigabecquerel(s)
GHz --- gigahertz
GPa --- gigapascal(s)
Gy --- gray
h --- hour(s)
Hz --- hertz
J --- joule(s)
joule(s)

GENERAL NOTE

The following paragraphs are applied to the List of Nuclear-Related Dual-Use Equipment, Material, Software, and Related Technology.

1. The description of any item on the List includes that item in either new or second-hand condition.

2. When the description of any item on the List contains no qualifications or specifications, it is regarded as including all varieties of that item. Category captions are only for convenience in reference and do not affect the interpretation of item definitions.

3. The object of these controls should not be defeated by the transfer of any non-controlled item (including plants) containing one or more controlled components when the controlled component or components are the principal element of the item and can feasibly be removed or used for other purposes.

   Note: In judging whether the controlled component or components are to be considered the principal element, governments should weigh the factors of quantity, value, and technological know-how involved and other special circumstances which might establish the controlled component or components as the principal element of the item being procured.

4. The object of these controls should not be defeated by the transfer of component parts. Each government will take such action as it can to achieve this aim and will continue to seek a workable definition for component parts, which could be used by all the suppliers.

TECHNOLOGY CONTROLS

The transfer of "technology" is controlled according to the Guidelines and as described in each section of the Annex. "Technology" directly associated with any item in the Annex will be subject to as great a degree of scrutiny and control as will the item itself, to the extent permitted by national legislation.

The approval of any Annex item for export also authorizes the export to the same end user of the minimum "technology" required for the installation, operation, maintenance, and repair of the item.

Note: Controls on "technology" transfer do not apply to information "in the public domain" or to "basic scientific research".

GENERAL SOFTWARE NOTE

The transfer of "software" is controlled according to the Guidelines and as described in the Annex.

Note: Controls on "software" transfers do not apply to "software" as follows:

1. Generally available to the public by being:
   a. Sold from stock at retail selling points without restriction; and
   b. Designed for installation by the user without further substantial support by the supplier;

   or
2. "In the public domain".

DEFINITIONS

"Accuracy" --

Usually measured in terms of inaccuracy, defined as the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.

"Angular position deviation" --

The maximum difference between angular position and the actual, very accurately measured angular position after the workpiece mount of the table has been turned out of its initial position. (Ref. VDI/VDE 2617 Draft: "Rotary table on coordinate measuring machines")

"Basic scientific research" --

Experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena and observable facts, not primarily directed toward a specific practical aim or objective.

"Contouring control" --

Two or more "numerically controlled" motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated. (Ref. ISO 2806-1980 as amended)

"Development" --

is related to all phases before "production" such as:

- design
- design research
- design analysis
- design concepts
- assembly and testing of prototypes
- pilot production schemes
- design data
- process of transforming design data into a product
- configuration design
- integration design
- layouts

"Fibrous or filamentary materials" --

means continuous ´monofilaments´, ´yarns´, ´rovings´, ´tows´ or ´tapes´.

N.B.:

1. ´Filament´ or ´monofilament´ --

   is the smallest increment of fiber, usually several µm in diameter.

2. ´Roving´ --

   is a bundle (typically 12-120) of approximately parallel ´strands´.

3. ´Strand´ --

   is a bundle of ´filaments´ (typically over 200) arranged approximately parallel.

4. ´Tape´ --

   is a material constructed of interlaced or unidirectional ´filaments´, ´strands´, ´rovings´, ´tows´ or ´yarns´, etc., usually preimpregnated with resin.

5. ´Tow´ --

   is a bundle of ´filaments´, usually approximately parallel.

6. ´Yarn´ --

   is a bundle of twisted ´strands´.

'Filament' --

See "Fibrous or filamentary materials".

"In the public domain" --

"Measurement uncertainty" --

The characteristic parameter which specifies in what range around the output value the correct value of the measurable variable lies with a confidence level of 95%. It includes the uncorrected systematic deviations, the uncorrected backlash, and the random deviations. (Ref. VDI/VDE 2617)

"Microprogram" --

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

'Monofilament' --

(b) Test Program (paragraph 4):

(1) Feed rate (velocity of slides) during measurement shall be the rapid traverse rate;

N.B.: In the case of machine tools which generate optical quality surfaces, the feed rate shall be equal to or less than 50 mm per minute;

(2) Measurements shall be made in an incremental manner from one limit of the axis travel to the other without returning to the starting position for each move to the target position;

(3) Axes not being measured shall be retained at mid-travel during test of an axis.

(c) Presentation of the test results (paragraph 2):

The results of the measurements must include:

(1) "positioning accuracy" (A) and

(2) The mean reversal error (B).

"Production" --

means all production phases such as:

- construction
- production engineering
- manufacture
- integration
- assembly (mounting)
- inspection
- testing
- quality assurance

"Program" --

A sequence of instructions to carry out a process in, or convertible into, a form executable by an electronic computer.

"Resolution" --

The least increment of a measuring device; on digital instruments, the least significant bit. (Ref. ANSI B-89.1.12)

“Roving” --

See "Fibrous or filamentary materials".

"Software" --

A collection of one or more "programs" or "microprograms" fixed in any tangible medium of expression.

'Strand' --

See "Fibrous or filamentary materials".

'Tape” --

See "Fibrous or filamentary materials".

"Technical assistance" --

"Technical assistance" may take forms such as: instruction, skills, training, working knowledge, consulting services.

Note: "Technical assistance" may involve transfer of "technical data".

"Technical data" --

"Technical data" may take forms such as blueprints, plans, diagrams, models, formulae, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories.

"Technology" --

means specific information required for the "development", "production", or "use" of any item contained in the List. This information may take the form of "technical data" or "technical assistance".

“Tow”

ANNEX CONTENTS

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1. INDUSTRIAL EQUIPMENT

1.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

1.A.1. High-density (lead glass or other) radiation shielding windows, having all of the following characteristics, and specially designed frames therefor:

a. A `cold area´ greater than 0.09 m^2;

b. A density greater than 3 g/cm^3; and

c. A thickness of 100 mm or greater.

Technical Note: *In Item 1.A.1.a. the term `cold area' means the viewing area of the window exposed to the lowest level of radiation in the design application.*

1.A.2. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand a total radiation dose greater than 5×10^4

(b) is capable of positioning or orienting material, parts, tools, or special devices through variable movements in three-dimensional space;

(c) incorporates three or more closed or open loop servo-devices which may include stepping motors; and

(d) has ´user-accessible programmability´ by means of teach/playback method or by means of an electronic computer which may be a programmable logic controller, i.e., without mechanical intervention.

N.B.1:

In the above definition ´sensors´ means detectors of a physical phenomenon, the output of which (after conversion into a signal that can be interpreted by a control unit) is able to generate "programs" or modify programmed instructions or numerical "program" data. This includes 'sensors' with machine vision, infrared imaging, acoustical imaging, tactile feel, inertial position measuring, optical or acoustic ranging or force or torque measuring capabilities.

N.B.2:

In the above definition ´user-accessible programmability´ means the facility allowing a user to insert, modify or replace "programs" by means other than:

(a) a physical change in wiring or interconnections; or

(b) the setting of function controls including entry of parameters.

N.B.3:

The above definition does not include the following devices:

(a) Manipulation mechanisms which are only manually/teleoperator controllable;

(b) Fixed sequence manipulation mechanisms which are automated moving devices operating according to mechanically fixed programmed motions. The "program" is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by mechanical, electronic, or electrical means;

(c) Mechanically controlled variable sequence manipulation mechanisms which are automated moving devices operating according to mechanically fixed programmed motions. The "program" is mechanically limited by fixed, but adjustable, stops such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed "program" pattern. Variations or modifications of the "program" pattern (e.g.,

changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations;

(d) Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The "program" is variable but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops;

(e) Stacker cranes defined as Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval.

2. 'End-effectors'

In Item 1.A.3. 'end-effectors' are grippers, ´active tooling units´, and any other tooling that is attached to the baseplate on the end of a 'robot' manipulator arm.

N.B.:

In the above definition ´active tooling units´ is a device for applying motive power, process energy or sensing to the workpiece.

1.A.4. Remote manipulators that can be used to provide remote actions in radiochemical separation operations or hot cells, having either of the following characteristics:

a. A capability of penetrating 0.6 m or more of hot cell wall (through-the-wall operation); or

b. A capability of bridging over the top of a hot cell wall with a thickness of 0.6 m or more (over-the-wall operation).

Technical Note: Remote manipulators provide translation of human operator actions to a remote operating arm and terminal fixture. They may be of a master/slave type or operated by joystick or keypad.

1.B. TEST AND PRODUCTION EQUIPMENT

1.B.1. Flow-forming machines, spin-forming machines capable of flow-forming functions, and mandrels, as follows:

a. Machines having both of the following characteristics:

1. Three or more rollers (active or guiding); and

2. Which, according to the manufacturer´s technical specification, can be equipped with "numerical control" units or a computer control;

b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 and 400 mm.

Note: Item 1.B.1.a. includes machines which have only a single roller designed to deform metal plus two auxiliary rollers which support the mandrel, but do not participate directly in the deformation process.

1.B.2. Machine tools, as follows, and any combination thereof, for removing or cutting metals, ceramics, or composites, which, according to the manufacturer's technical specifications, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes:

N.B.: For "numerical control" units controlled by their associated "software", see Item 1.D.3.

a. Machine tools for turning, that have "positioning accuracies" with all compensations available better (less) than 6 µm according to ISO 230/2 (1988) along any linear axis (overall positioning) for machines capable of machining diameters greater than 35 mm;

Note: Item 1.B.2.a. does not control bar machines (Swissturn), limited to machining only bar feed thru, if maximum bar diameter is equal to or less than 42 mm and there is no capability of mounting chucks. Machines may have drilling and/or milling capabilities for machining parts with diameters less than 42 mm.

b. Machine tools for milling, having any of the following characteristics:

1. "Positioning accuracies" with all compensations available better (less) than 6 µm according to ISO 230/2 (1988) along any linear axis (overall positioning);

2. Two or more contouring rotary axes; or

3. Five or more axes which can be coordinated simultaneously for "contouring [capaTJ17.1858 0 TD."5)T

a. Limited to a maximum workpiece capacity of 150 mm outside diameter or length; and

b. Axes limited to x, z and c.

2. Jig grinders that do not have a z-axis or a w-axis with an overall positioning accuracy less (better) than 4 microns. Positioning accuracy is according to ISO 230/2 (1988).

d. Non-wire type Electrical Discharge Machines (EDM) that have two or more contouring rotary axes and that can be coordinated si

2. *Not counted in the total number of contouring axes are secondary parallel contouring axes (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the centerline of which is parallel to the primary rotary axis).*

3. *Rotary axes do not necessarily have to rotate over 360 degrees. A rotary axis can be driven by a linear device, e.g., a screw or a rack-and-pinion.*

4. *For the purposes of 1.B.2. the number of axes which can be coordinated simultaneously for "contouring control" is the number of axes along or around which, during processing of the workpiece, simultaneous and interrelated motions are performed between the workpiece and a tool. This does not include any additional axes along or around which other relative motions within the machine are performed, such as:*

   a. *Wheel-dressing systems in grinding machines;*

   b *Parallel rotary axes designed for mounting of separate workpieces;*

   c. *Co-linear rotary axes designed for manipulating the same workpiece by holding it in a chuck from different ends.*

5. *A machine tool having at least 2 of the 3 turning, milling or grinding capabilities (e.g., a turning machine with milling capability) must be evaluated against each applicable entry, 1.B.2.a., 1.B.2.b. and 1.B.2.c.*

6. *Items 1.B.2.b.3 and 1.B.2.c.3 include machines based on a parallel linear kinematic design (e.g., hexapods) that have 5 or more axes none of which are rotary axes.*

1.B.3. Dimensional inspection machines, instruments, or systems, as follows:

furnaces specified in Item 1.B.4.a.

1.B.5. ´Isostatic presses´, and related equipment, as follows:

a. ´Isostatic presses´ having both of the following characteristics:

1. Capable of achieving a maximum working pressure of 69 MPa or greater; and

2. A chamber cavity with an inside diameter in excess of 152 mm;

b. Dies, molds, and controls specially designed for the ´isostatic presses´ specified in Item 1.B.5.a.

Technical Notes:

1. In Item 1.B.5. ´Isostatic presses' means equipment capable of pressurizing a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal pressure in all directions within the cavity upon a workpiece or material.

2. In Item 1.B.5. the inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

1.B.6. Vibration test systems, equipment, and components as follows:

a. Electrodynamic vibration test systems, having all of the following characteristics:

1. Employing feedback or closed loop control techniques and incorporating a digital control unit;

2. Capable of vibrating at 10 g RMS or more between 20 and 2000 Hz; and

2. MATERIALS

2.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

2.A.1. Crucibles made of materials resistant to liquid actinide metals, as follows:

a. Crucibles having both of the following characteristics:

1. A volume of between 150 cm^3 (150 ml) and 8000 cm^3 (8 liters); and

2. Made of or coated with any of the following materials, having a purity of 98% or greater by weight:

a. Calcium fluoride (CaF_2);

b. Calcium zirconate (metazirconate) (CaZrO3);

c. Cerium sulfide (Ce2S3);

d. Erbium oxide (erbia) (Er2O3);

e. Hafnium oxide (hafnia) (HfO2);

f. Magnesium oxide (MgO);

g. Nitrided niobium-titanium-tungsten allo

2.A.3. Composite structures in the form of tubes having both of the following characteristics:

a. An inside diameter of between 75 and 400 mm; and

b. Made with any of the "fibrous or filamentary materials" specified in Item 2.C.7.a. or carbon prepreg materials specified in Item 2.C.7.c.

2.B. TEST AND PRODUCTION EQUIPMENT

2.B.1. Tritium facilities or plants, and equipment therefor, as follows:

a. Facilities or plants for the production, recovery, extraction, concentration or handling of tritium;

b. Equipment for tritium facilities or plants, as follows:

1. Hydrogen or helium refrigeration units capable of cooling to 23 K (-250 ºC) or less, with heat removal capacity greater than 150 W;

2. Hydrogen isotope storage or purification systems using metal hydrides as the storage or purification medium.

2.B.2. Lithium isotope separation facilities or plants, and equipment therefor, as follows:

a. Facilities or plants for the separation of lithium isotopes;

b. Equipment for the separation of lithium isotopes, as follows:

1. Packed liquid-liquid exchange columns specially designed for lithium amalgams;

2. Mercury or lithium amalgam pumps;

3. Lithium amalgam electrolysis cells;

4. Evaporators for concentrated lithium hydroxide solution.

2.C. MATERIALS

2.C.1. Aluminium alloys having both of the following characteristics:

a. 'Capable of' an ultimate tensile strength of 460 MPa or more at 293 K (20 °C); and

b. In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm.

Technical Note:

2.C.2. Beryllium metal, alloys containing more than 50% beryllium by weight, beryllium compounds,

2. A ´specific tensile strength´ of 7.62 x 10^4 m or greater;

c. Thermoset resin impregnated continuous "yarns", "rovings", "tows" or "tapes" with a width of 15 mm or less (prepregs), made from carbon or glass "fibrous or filamentary materials"

2.C.13. Titanium alloys having both of the following characteristics:

2.C.17. Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen

3. URANIUM ISOTOPE SEPARATION EQUIPMENT AND COMPONENTS (Other Than Trigger List Items)

3.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

3.A.1. Frequency changers or generators having all of the following characteristics:

N.B.: Frequency changers and generators especially designed or prepared for the gas centrifuge process are controlled under INFCIRC/254/Part 1 (as amended).

a. Multiphase output capable of providing a power of 40 W or greater;

b. Capable of operating in the frequency range between 600 and 2000 Hz;

c. Total harmonic distortion better (less) than 10%; and

d. Frequency control better (less) than 0.1%.

Technical Note: Frequency changers in Item 3.A.1. are also known as converters or inverters.

3.A.2. Lasers, laser amplifiers and oscillators as follows:

h. Pulsed excimer lasers (XeF, XeCl, KrF) having all of the following characteristics:

1. Operating at wavelengths between 240 and 360 nm;

2. A repetition rate greater than 250 Hz; and

3. An average output power greater than 500 W;

i. Para-hydrogen Raman shifters designed to operate at 16 μm output wavelength and at a repetition rate greater than 250 Hz.

3.A.3. Valves having all of the following characteristics:

a. A nominal size of 5 mm or greater;

b. Having a bellows seal; and

c. Wholly made of or lined with aluminium, aluminium alloy, nickel, or nickel alloy containing more than 60% nickel by weight.

Technical Note: *For valves with different inlet and outlet diameter, the nominal size parameter in Item 3.A.3.a. refers to the smallest diameter.*

3.A.4. Superconducting solenoidal electromagnets having all of the following characteristics:

a. Capable of creating magnetic fields greater than 2 T;

b. A ratio of length to inner diameter greater than 2;

c. Inner diameter greater than 300 mm; and

d. Magnetic field uniform to better than 1% over the central 50% of the inner volume.

Note: Item 3.A.4. does not control magnets specially designed for and exported *as part of* medical nuclear magnetic resonance (NMR) imaging systems.

N.B.: *As part of,* does not necessarily mean physical part in the same shipment. Separate shipments from different sources are allowed, provided the related export documents clearly specify the *as part of* relationship.

3.A.5. High-power direct current power supplies having both of the following characteristics:

a. Capable of continuously producing,322 0 i Tw[m)7.cGs-miu ld - of7.cl c 53adoes necn characTw[3.A.5.)

nuously producing,322 0 i Tw[m)7.cGs-

b. Current or voltage stability better th

0 to 13 kPa and having both of the following characteristics:

a. Pressure sensing elements made of or protected by aluminium, aluminium alloy, nickel, or nickel alloy with more th10960% nickel by weight; and

b. Having eithe2.of the following characteristics:

    1. A full scale of less th10913 kPa and 109“accuracy” of better th109± ovtf full scale; or

b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;

Technical Note: *In Item 3.B.2.b. such equipment normally consists of precision measuring*

2. Specially designed to fabricate composite structures or laminates from "fibrous or filamentary materials"; and

3. Capable of winding cylindrical rotors of diameter between 75 and 400 mm and lengths of 600 mm or greater;

b. Coordinating and programming controls for the filament winding machines specified in Item 3.B.4.a.;

c. Precision mandrels for the filament winding machines specified in Item 3.B.4.a.

3.B.5. Electromagnetic isotope separators designed for, or equipped with, single or multiple ion sources capable of providing a total ion beam current of 50 mA or greater.

Notes: 1. Item 3.B.5. includes separators capable of enriching stable isotopes as well as those for uranium.

N.B.: A separator capable of separating the isotopes of lead with a one-mass unit difference is inherently capable of enriching the isotopes of uranium with a three-unit mass difference.

2. Item 3.B.5. includes separators with the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.

Technical Note: *A single 50 mA ion source cannot produce more than 3 g of separated highly enriched uranium (HEU) per year from natural abundance feed.*

3.B.6. Mass spectrometers capable of measuring ions of 230 atomic mass units or greater and having a resolution of better than 2 parts in 230, as follows, and ion sources therefor:

N.B.: Mass spectrometers especially designed or prepared for analyzing on-line samples of uranium hexafluoride are controlled under INFCIRC/254/Part 1 (as amended).

a. Inductively coupled plasma mass spectrometers (ICP/MS);

b. Glow discharge mass spectrometers (GDMS);

c. Thermal ionization mass spectrometers (TIMS);

d. Electron bombardment mass spectrometers which have a source chamber constructed from, lined with or plated with materials resistant to UF_6;

e. Molecular beam mass spectrometers having either of the following characteristics:

1. A source chamber constructed from, lined with or plated with stainless steel or molybdenum, and equipped with a cold trap capable of cooling to 193 K (-80 °C) or less; or

2. A source chamber constructed from, lined with or plated with materials resistant to UF_6;

f. Mass spectrometers equipped with a microfluorination ion source designed for actinides or actinide fluorides.

3.C. MATERIALS

None.

3.D. SOFTWARE

3.D.1. "Software" specially designed for the "use" of equipment specified in Item 3.B.3. or 3.B.4.

3.E. TECHNOLOGY

3.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software" specified in 3.A. through 3.D.

5. TEST AND MEASUREMENT EQUIPMENT FOR THE DEVELOPMENT OF NUCLEAR EXPLOSIVE DEVICES

5.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

5.A.1. Photomultiplier tubes having both of the following characteristics:

a. Photocathode area of greater than 20 cm^2; and

b. Anode pulse rise time of less than 1 ns.

5.B. TEST AND PRODUCTION EQUIPMENT

5.B.1. Flash X-ray generators or pulsed electron accelerators having either of the following sets of characteristics:

a. 1. An accelerator peak electron energy of 500 keV or greater but less than 25 MeV; and

2. With a figure of merit (K) of 0.25 or greater; or

b. 1. An accelerator peak electron energy of 25 MeV or greater; and

2. A peak power greater than 50 MW.

Note: Item 5.B.1. does not control accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) nor those designed for medical purposes.

Technical Notes:

1. The figure of merit K is defined as: $K=1.7 \times 10^3 V^{2.65} Q$. *V is the peak electron energy in million electron volts. If the accelerator beam pulse duration is less than or equal to 1 μs, then Q is the total accelerated charge in Coulombs. If the accelerator beam pulse duration is greater than 1 μs, then Q is the maximum accelerated charge in 1 μs. Q equals the integral of i with respect to t, over the lesser of 1 μs or the time duration of the beam pulse (* $Q=\int idt$ *) where i is beam current in amperes and t is the time in seconds.*

2. Peak power = (peak potential in volts) x *(peak beam current in amperes).*

3. In machines based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 μs or the duration of the bunched beam packet resulting from one microwave modulator pulse.

4. In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.

5.B.2. Multistage light gas guns or other high-velocity gun systems (coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to 2 km/s or greater.

5.B.3. Mechanical rotating mirror cameras, as follows, and specially designed components therefor:

a. Framing cameras with recording rates greater than 225000 frames per second;

b. Streak cameras with writing speeds greater than 0.5 mm/μs.

Note: In Item 5.B.3. components of such cameras include their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors, and bearings.

5.B.4. Electronic streak cameras, electronic framing cameras, tubes and devices, as follows:

a. Electronic streak cameras capable of 50 ns or less time resolution;

b. Streak tubes for cameras specified in Item 5.B.4.a.;

c. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;

d. Framing tubes and solid-state imaging devices for use with cameras specified in Item 5.B.4.c., as follows:

1. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;

2. Gate silicon intensifier target (SIT) vidicon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;

3. Kerr or Pockels cell electro-optical shuttering;

4. Other framing tubes and solid-state imaging devices having a fast image gating time of less than 50 ns specially designed for cameras specified in Item 5.B.4.c.

5.B.5. Specialized instrumentation for hydrodynamic experiments, as follows:

a. Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 μs;

b. Manganin gauges for pressures greater than 10 GPa;

c. Quartz pressure transducers for pressures greater than 10 GPa.

Note: Item 5.B.5.a. includes velocity interferometers such as VISARs (Velocity interferometer systems for any reflector) and DLIs (Doppler laser interferometers).

5.B.6. High-speed pulse generators having both of the following characteristics:

a. Output voltage greater than 6 V into a resistive load of less than 55 ohms; and

b. 'Pulse transition time' less than 500 ps.

Technical Note: *In Item 5.B.6.b. 'pulse transition time' is defined as the time interval between 10% and 90% voltage amplitude.*

5.C. MATERIALS

None.

5.D. SOFTWARE

None.

5.E. TECHNOLOGY

5.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software" specified in 5.A. through 5.D.

6. COMPONENTS FOR NUCLEAR EXPLOSIVE DEVICES

6.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

6.A.1. Detonators and multipoint initiation systems, as follows:

a. Electrically driven explosive detonators, as follows:

6. No dimension greater than 25.4 cm;

7. Weight less than 25 kg ; and

8. Specified to operate over an exte

b. 1. Voltage rating greater than 750 V;

2. Capacitance greater than 0.25 μF; and

3. Series inductance less than 10 nH.

6.A.5. Neutron generator systems, including tubes, having both of the following characteristics:

a. Designed for operation without an external vacuum system; and

b. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.

6.B. TEST AND PRODUCTION EQUIPMENT

None.

6.C. MATERIALS

6.C.1. High explosive substances or mixtures, containing more than 2 % by weight of any of the following:

a. Cyclotetramethylenetetranitramine (HMX) (CAS 2691-41-0);

b. Cyclotrimethylenetrinitramine (RDX) (CAS 121-82-4);

c. Triaminotrinitrobenzene (TATB) (CAS 3058-38-6);

d. Hexanitrostilbene (HNS) (CAS 20062-22-0); or

e. Any explosive with a crystal density greater than 1.8 g/cm^3 and having a detonation velocity greater than 8000 m/s.

6.D. SOFTWARE

None.

6.E. TECHNOLOGY

6.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software" specified in 6.A. through 6.D.

COMPARISON TABLE OF CHANGES TO THE GUIDELINES FOR NUCLEAR TRANSFERS (INFCIRC/254/Rev. 7/Part 2)

Old	New
1.B.3. Dimensional inspection machines, instruments, or systems, as follows:	
a. Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics:	

Old	New

b. Maintain for at least 12 hours, over a temperature range of ± 1 K around a standard temperature and a standard pressure:

1. A "resolution" over their full scale of 0.1 µm or better; and

2. With a "measurement uncertainty" equal to or better (less) than (0.2 + L/2000) µm (L is the measured length in millimeters);

Note: Item 1.B.3.b.3. does not control measuring interferometer systems, without closed or open loop feedback, containing a laser to measure slide movement errors of machine tools, dimensional inspection machines, or similar equipment.

Technical Note: *In Item 1.B.3.b. 'linear displacement' means the change of distance between the measuring probe and the measured object.*

c. Angular displacement measuring instruments having an "angular position deviation" equal to or better (less) than 0.00025°;

Note:

COMPARISON TABLE OF CHANGES TO THE GUIDELINES FOR NUCLEAR TRANSFERS (INFCIRC/254/Rev. 7/Part 2)

Old	New
1. "Measurement uncertainty" along any linear axis equal to or better (less) than 3.5 µm per 5 mm; and 2. "Angular position deviation" equal to or less than 0.02°. Notes: 1. Item 1.B.3. includes machine tools that can be used as measuring machines if they meet or exceed the criteria specified for the measuring machine function. 2. Machines described in Item 1.B.3. are controlled if they exceed the threshold specified anywhere within their operating range. *Technical Notes:* *1. The probe used in determining the measurement uncertainty of a dimensional inspection system shall be as described in VDI/VDE 2617 parts 2, 3 and 4.* *2. All parameters of measurement values in this item represent plus/minus, i.e., not total band.*	c. Angular displacement measuring instruments having an "angular position deviation" equal to or better (less) than 0.00025°; Note: Item 1.B.3.c. does not control optical instruments, such as autocollimators, using collimated light (e.g., laser light) to detect angular displacement of a mirror. d. Systems for simultaneous linear-angular inspection of hemishells, having both of the following characteristics: 1. "Measurement uncertainty" along any linear axis equal to or better (less) than 3.5 µm per 5 mm; and 2. "Angular position deviation" equal to or less than 0.02°. Notes: 1. Item 1.B.3. includes machine tools that can be used as measuring machines if they meet or exceed the criteria specified for the measuring machine function. 2. Machines described in Item 1.B.3. are controlled if they exceed the threshold specified anywhere within their operating range. *Technical Note~~s~~:* ~~*1. The probe used in determining the measurement uncertainty of a dimensional inspection system shall be*~~

COMPARISON TABLE OF CHANGES TO THE GUIDELINES FOR NUCLEAR TRANSFERS (INFCIRC/254/Rev. 7/Part 2)

Old	New
	measurement values in this item represent plus/minus, i.e., not total band.