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COMMUNICATION RECEIVED FROM MEMBERS REGARDING EXPORT OF NUCLEAR MATERIAL AND OF CERTAIN CATEGORIES OF EQUIPMENT AND OTHER MATERIAL

1. The Director General has received letters from the Resident Representatives to the Agency of the following Member States concerning the commitments of these Member States under Article III, paragraph 2, of the Treaty on the Non-Proliferation of Nuclear Weapons (the date of each letter is given in parentheses after the name of the Member State):

Australia (25 January 1984)
Canada (13 February 1984)
Czechoslovakia (24 January 1984)
Finland (24 January 1984)
German Democratic Republic (24 January 1984)
Federal Republic of Germany (24 January 1984)
Ireland (24 January 1984)
Japan (24 January 1984)
Netherlands (24 January 1984)
Norway (24 January 1984)
Poland (24 January 1984)
Sweden (31 January 1984)
Union of Soviet Socialist Republics (24 January 1984)
United Kingdom of Great Britain and Northern Ireland (24 January 1984)
United States of America (24 January 1984)

2. In light of the wish expressed at the end of each of the letters, both the text of the letters and their Annex are attached.

LETTER

"I have the honour to refer to [relevant previous communication] from the Resident Representative of [Member State] to the International Atomic Energy Agency.

"In the years since the procedures for export of nuclear materials and of certain categories of equipment and other material enclosed with these notes were formulated, there have been considerable changes in nuclear technology which make it desirable, in the view of my Government, to clarify those parts of the trigger list which refer to the gas centrifuge enrichment process.

"In relation to the Annex entitled "Clarifications of Items on the Trigger List" attached to Memorandum B, I therefore wish to inform you that the items relating to this process and specified in paragraph 11 of that Annex include:

"(a) Assemblies and components especially designed or prepared for use in gas centrifuges. This includes rotating and static components listed in sections 1.1 and 1.2 of the Annex to this letter;

"(b) Especially designed or prepared auxiliary systems, equipment and components for gas centrifuge enrichment plants. This includes the items listed in section 2 of the Annex to this letter.

"Both categories of items are introduced by explanatory notes.

"As hitherto, my Government reserves to itself discretion as to the interpretation and implementation of the procedures provided in the above-mentioned notes and the right to control, if it wishes, the export of items relevant to the gas centrifuge enrichment process other than those specified in the Annex to this letter.

"I should be grateful if you would circulate the text of this letter and its Annex to all Member Governments for their information. "

A N N E X

1. Assemblies and components especially designed or prepared for use in gas centrifuges

Note:

The gas centrifuge normally consists of a thin-walled cylinder(s) of between 75 mm (3 ins) and 400 mm (16 ins) diameter contained in a vacuum environment and spun at high peripheral speed of the order of 300 m/sec or more with its central axis vertical. In order to achieve high speed the materials of construction for the rotating components have to be of a high strength to density ratio and the rotor assembly, and hence its individual components, have to be manufactured to very close tolerances in order to minimize the unbalance. In contrast to other centrifuges, the gas centrifuge for uranium enrichment is characterized by having within the rotor chamber a rotating disc-shaped baffle(s) and a stationary tube arrangement for feeding and extracting the UF_6 gas and featuring at least 3 separate channels, of which 2 are connected to scoops extending from the rotor axis towards the periphery of the rotor chamber. Also contained within the vacuum environment are a number of critical items which do not rotate and which although they are especially designed are not difficult to fabricate nor are they fabricated out of unique materials. A centrifuge facility however requires a large number of these components, so that quantities can provide an important indication of end use.

1.1. Rotating Components

(a) Complete Rotor Assemblies:

Thin-walled cylinders, or a number of interconnected thin-walled cylinders, manufactured from one of the high strength to density ratio materials described in the Footnote to this Section;

If interconnected, the cylinders are joined together by flexible bellows or rings as described in Section 1.1(c) following. The rotor is fitted with an internal baffle(s) and end caps, as described in Section 1.1(d) and (e) following, if in final form. However the complete assembly may be delivered only partly assembled.

(b) Rotor Tubes:

Especially designed or prepared thin-walled cylinders with thickness of 12 mm (.50 in) or less, a diameter of between 75 mm (3 ins) and 400 mm (16 ins), and manufactured from one of the high strength to density ratio materials described in the Footnote to this Section.

(c) Rings or Bellows:

Components especially designed or prepared to give localized support to the rotor tube or to join together a number of rotor tubes. The bellows is a short cylinder of wall thickness 3mm (.125 ins) or less, a diameter of between 75 mm (3 ins) and 400 mm (16 ins), having a convolute, and manufactured from one of the high strength to density ratio materials described in the Footnote to this Section.

(d) Baffles:

Disc-shaped components of between 75 mm (3 ins) and 400 mm (16 ins) diameter especially designed or prepared to be mounted inside the centrifuge rotor tube, in order to isolate the take-off chamber from the main separation chamber and, in some cases, to assist the UF_6 gas circulation within the main separation chamber of the rotor tube, and manufactured from one of the high strength to density ratio materials described in the Footnote to this Section.

(e) Top Caps/Bottom Caps:

Disc-shaped components of between 75 mm (3 ins) and 400 mm (16 ins) diameter especially designed or prepared to fit to the ends of the rotor tube, and so contain the UF_6 within the rotor tube, and in some cases to support, retain or contain as an integrated part an element of the upper bearing (top cap) or to carry the rotating elements of the motor and lower bearing (bottom cap), and manufactured from one of the high strength to density ratio materials described in the Footnote to this Section.

Footnote

The materials used for centrifuge rotating components are:

(a) Maraging steel capable of an ultimate tensile strength of 2.050×10^9 N/m^2 (300 000 lb/in^2) or more;

(b) Aluminium alloys capable of an ultimate tensile strength of 0.460×10^9 N/m^2 (67 000 lb/in^2) or more;

(c) Filamentary materials suitable for use in composite structures and having a specific modulus of 12.3×10^6 or greater and a specific ultimate tensile strength of 0.3×10^6 or greater ('Specific Modulus' is the Young's Modulus in N/m^2 divided by the density in kg/m^3: 'Specific Ultimate Tensile Strength' is the ultimate tensile strength in N/m^2 divided by the density in kg/m^3).

1.2. Static Components

(a) Magnetic Suspension Bearings:

Especially designed or prepared bearing assemblies consisting of an annular magnet suspended within a housing containing a damping medium. The housing will be manufactured from a UF_6 resistant material (see footnote to Section 2). The magnet couples with a pole piece or a second magnet fitted to the top cap described in Section 1.1(e). The magnet may be ring-shaped with a relation between outer and inner diameter smaller or equal to 1.6:1. The magnet may be in a form having an initial permeability of 0.15 Henry/metre (120 000 in CGS units) or more, or a remanence of 98.5% or more, or an energy product of greater than 80 000 joules/m^3 (10 x 10^6 gauss-oersteds). In addition to the usual material properties, it is a prerequisite that the deviation of the magnetic axes from the geometrical axes is limited to very small tolerances (lower than 0.1 mm) or that homogeneity of the material of the magnet is specially called for.

(b) Bearings/Dampers:

Especially designed or prepared bearings comprising a pivot/cup assembly mounted on a damper. The pivot is normally a hardened steel shaft polished into a hemisphere at one end with a means of attachment to the bottom cap described in Section 1.1(e) at the other. The shaft may how-ever have a hydrodynamic bearing attached. The cup is pellet-shaped with a hemispherical indentation in one surface. These components are often supplied separately to the damper.

(c) Molecular Pumps:

Especially designed or prepared cylinders having internally machined or extruded helical grooves and internally machined bores. Typical dimensions are as follows: 75 mm (3 ins) to 400 mm (16 ins) internal diameter, 10 mm (0.4 in) or more wall thickness, 1 to 1 length to diameter ratio. The grooves are typically rectangular in cross-section and 2 mm (0.08 in) or more in depth.

(d) Motor Stators:

Especially designed or prepared ring-shaped stators for high speed multi-phase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600-2000 Hertz and a power range of 50-1000 volts amps. The stators consist of multi-phase windings on a laminated low loss iron core comprised of thin layers typically 2.0 mm (0.080 in) thick or less.

2. Especially designed or prepared auxiliary systems, equipment and components for gas centrifuge enrichment plants

Note:

The auxiliary systems, equipment and components for a gas centrifuge enrichment plant are the systems of plant needed to feed UF_6 to the centrifuges to link the individual centrifuges to each other to form cascades

(or stages) to allow for progressively higher enrichments and to extract the 'product' and 'tails' UF_6 from the centrifuges, together with the equipment required to drive the centrifuges or to control the plant.

Normally UF_6 is evaporated from the solid using heated autoclaves and is distributed in gaseous form to the centrifuges by way of cascade header pipework. The 'product' and 'tails' UF_6 gaseous streams flowing from the centrifuges are also passed by way of cascade header pipework to cold traps (operating at about -70°C) where they are condensed prior to onward transfer into suitable containers for transportation or storage. Because an enrichment plant consists of many thousands of centrifuges arranged in cascades there are many kilometres of cascade header pipework, incorporating thousands of welds with a substantial amount of repetition of layout. The equipment, components and piping systems are fabricated to very high vacuum and cleanliness standards.

The items listed below either come into direct contact with the UF_6 process gas or directly control the centrifuges and the passage of the gas from centrifuge to centrifuge and cascade to cascade.

(a) Feed Systems/Product and Tails Withdrawal Systems:

Especially designed or prepared process systems including:

- Feed autoclaves (or stations), used for passing UF_6 to the centrifuge cascades at up to 100 KN/m^2 (15 lb/in^2) and at a rate of 1 kg/hr or more;

- Desublimers (or cold traps) used t remove UF_6 from the cascades at up to 3 KN/m^2 (0.5 lb/in^2) pressure. The desublimers are capable of being chilled to -70°C and heated to 70°C;

- 'Product' and 'Tails' stations used for trapping UF_6 into containers.

This plant, equipment and pipework is wholly made of or lined with UF_6 resistant materials (see footnote to this section) and is fabricated to very high vacuum and cleanliness standards.

(b) Machine Header Piping Systems:

Especially designed or prepared piping systems and header systems for handling UF_6 within the centrifuge cascades. This piping network is normally of the 'triple' header system with each centrifuge connected to each of the headers. There is thus a substantial amount of repetition in its form. It is wholly made of UF_6 resistant materials (see footnote to this Section) and is fabricated to very high vacuum and cleanliness standards.

(c) UF_6 Mass Spectrometers/Ion Sources:

Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking 'on-line' samples of feed, product or tails, from UF_6 gas streams and having all of the following characteristics:

1. Unit resolution for mass greater than 320;

2. Ion sources constructed of or lined with nichrome or monel or nickel plated;

3. Electron bombardment ionization sources;

4. Having a collector system suitable for isotopic analysis.

(d) Frequency Changers

Frequency changers (also known as convertors or invertors) especially designed or prepared to supply motor stators as defined under 1.2.(d), or parts, components and sub-assemblies of such frequency changers having all of the following characteristics:

1. A multiphase output of 600 Hz to 2000 Hz;

2. High stability (with frequency control better than 0.1%);

3. Low harmonic distortion (less than 2%); and

4. An efficiency of greater than 80%.

Footnote

Materials resistant to corrosion by UF_6 include stainless steel, aluminium, aluminium alloys, nickel or alloys containing 60% or more nickel.