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

1. The Director General has received a letter dated 28 January 1986 from the Permanent Representative of Hungary to the Agency concerning the commitments of Hungary under Article III, paragraph 2, of the Treaty on the Non-Proliferation of Nuclear Weapons.[1/]

2. In this letter the Permanent Representative states that it is the intention of the Government of Hungary to act in accordance with certain procedures relating to exports of nuclear material and of certain categories of equipment and other material which are set forth in documents INFCIRC/209/Add.3, INFCIRC/209/Mod.1, INFCIRC/209/Mod.2 and, INFCIRC/209/Mod.3.

3. In the light of the wish expressed at the end of the letter from the Permanent Representative of Hungary, the text of the letter with its annexes is reproduced in the Attachment.

1/ Reproduced in document INFCIRC/140

86-00790

LETTER OF 28 JANUARY 1986 TO THE DIRECTOR GENERAL
FROM THE PERMANENT REPRESENTATIVE OF HUNGARY

"I have the honour to refer to the letter dated 25 November 1974 from the Chairman of the Hungarian National Atomic Energy Commission to the International Atomic Energy Agency [reproduced in INFCIRC/209/Add.3].

"In the years since the procedures for export of nuclear materials and of certain categories of equipment and other material described in INFCIRC/209 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 uranium enrichment technology with specific reference to the gas centrifuge enrichment process, and also to fuel reprocessing technology, as well as to incorporate several corrections listed below:

I.

"The Government of Hungary has instructed me to inform your that it is now its intention to act in accordance with …. Memorandum [B in INFCIRC/209] amended as indicated in Annex A to this letter.

II.

"In relation to the annex entitled "Clarifications of Items on the Trigger List" attached to Memorandum B in INFCIRC/209, I 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 Annex B 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 Annex B to this letter.

"Both categories of items are introduced by explanatory notes.

III.

"In relation to the annex entitled "Clarifications of Items on the Trigger List" attached to Memorandum B in INFCIRC/209, I wish to inform you that the items relating to fuel reprocessing plants and specified in paragraph 7 of that annex also include the items listed in Annnex C to this letter. These items are introduced by an explanatory note.

"As hitherto, my Government reserves to itself discretion as to the interpretation and implementation of the procedures provided in the above-mentioned documents and the right to control, if it wishes, the export of items relevant to gas centrifuge enrichment and fuel reprocessing plants other than those specified in INFCIRC/209 and in the annexes to this letter.

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

ANNEX A

(a) Paragraph 2.1.6 shall read:

"Zirconium tubes: Zirconium metal and alloys in the form of tubes or assemblies of tubes, and in quantities exceeding 500 kg per year, especially designed or prepared for use in a reactor as defined in paragraph 2.1.1 above and in which the relationship of hafnium to zirconium is less than 1:500 parts by weight."

(b) A new paragraph following paragraph 2.5.1 shall read:

"2.6.1. Plants for the production of heavy water, deuterium and deuterium compounds and equipment especially designed or prepared therefor."

(c) A new sentence following the first sentence of paragraphs F of the annex to INFCIRC/209 shall read:

"Such items include:

gaseous diffusion barriers
gaseous diffuser housings
gas centrifuge assemblies, corrosion resistant to UF_6
jet nozzle separation units
vortex separation units
large UF_6 corrosion-resistant axial or centrifugal compressors
special compressor seals for such compressors."

A N N E X B

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 UF6 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 (10×10^6 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 however 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 to 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 UF6 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 UF6 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 UF6 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.

A N N E X C

INTRODUCTORY NOTE: SPENT NUCLEAR FUEL REPROCESSING

Reprocessing irradiated nuclear fuel separates plutonium and uranium from intensely radioactive fission products and other transuranic elements. Different technical processes can accomplish this separation. However, over the years Purex has become the most commonly used and accepted process. Purex involves the dissolution of irradiated nuclear fuel in nitric acid, followed by separation of the uranium, plutonium, and fission products by solvent extraction using a mixture of tributyl phosphate in an organic diluent.

Purex facilities have process functions similar to each other, including: irradiated fuel element chopping, fuel dissolution, solvent extraction, and process liquor storage. There may also be equipment for thermal denitration of uranium nitrate, conversion of plutonium nitrate to oxide or metal, and treatment of fission product waste liquor to a form suitable for long-term storage or disposal. However, the specific type and configuration of the equipment performing these functions may differ between Purex facilities for several reasons, including the type and quantity of irradiated nuclear fuel to be reprocessed and the intended disposition of the recovered materials, and the safety and maintenance philosophy incorporated into the design of the facility.

The equipment listed below performs key reprocessing functions. Each comes into direct contact with the irradiated fuel or process liquor and operates in an environment characterised by criticality, radiation, and toxicity hazards. These make remote control of the process essential.

(1) Fuel element chopping

This equipment breaches the cladding of the fuel to expose the irradiated nuclear material to dissolution. Especially designed metal cutting shears are the most commonly employed, although advanced equipment, such as lasers, may be used.

(2) Dissolvers

Dissolvers normally receive the chopped up spent fuel. In these critically safe vessels, the irradiated nuclear material is dissolved in nitric acid and the remaining hulls removed from the process stream.

(3) Solvent extractors

Solvent extractors both receive the solution of irradiated fuel from the dissolvers and the organic solution which separates the uranium, plutonium, and fission products. Solvent extraction equipment is normally designed to meet strict operating parameters, such as long operating lifetimes with no maintenance requirements or adaptability to easy replacement, simplicity of operation and control, and flexibility for variations in process conditions.

(4) Holding or storage vessels

Three main process liquor streams result from the solvent extraction step. Holding or storage vessels are used in the further processing of all three streams, as follows:

(a) The pure uranium nitrate solution is concentrated by evaporation and passed to a denitration process where it is converted to uranium oxide. This oxide is reused in the nuclear fuel cycle.

(b) The intensely radioactive fission products solution is normally concentrated by evaporation and stored as a liquor concentrate. This concentrate may be subsequently evaporated and converted to a form suitable for storage or disposal.

c) The pure plutonium nitrate solution is concentrated and stored pending its transfer to further process steps. In particular, holding or storage vessels for plutonium solutions are designed to avoid criticality problems resulting from changes in concentration and form of this stream.

(5) Plutonium nitrate to oxide conversion system

In most reprocessing facilities, this final process involves the conversion of the plutonium nitrate solution to plutonium dioxide. The main functions involved in this process are: process feed storage and adjustment, precipitation and solid/liquor separation, calcination, product handling, ventilation, waste management, and process control.

(6) Plutonium oxide to metal conversion system

This, process, which could be related to a reprocessing facility, involves the fluorination of plutonium dioxide, normally with highly corrosive hydrogen fluoride, to produce plutonium fluoride which is subsequently reduced using high purity calcium metal to produce metallic plutonium and a calcium fluoride slag. The main functions involved in this process are: fluorination (eg involving equipment fabricated or lined with a precious metal), metal reduction (eg employing ceramic crucibles), slag recovery, product handling, ventilation, waste management and process control.

These processes, including the complete systems for plutonium conversion and plutonium metal production, may be identified by the measures taken to avoid criticality (eg by geometry), radiation exposure (eg by shielding), and toxicity hazards (eg by containment).

DEFINITIONS FOR REPROCESSING

A. Solvent extraction equipment - Especially designed or prepared solvent extractors such as packed or pulse columns, mixer settlers or centrifugal contactors for use in a plant for the reprocessing of irradiated fuel. Solvent extractors must be resistant to the corrosive effect of nitric acid. Solvent extractors are normally fabricated to extremely high standards (including special welding and inspection and quality assurance and quality control techniques) out of low carbon stainless steels, titanium, zirconium or other high quality materials.

B. Chemical holding or storage vessels - Especially designed or prepared holding or storage vessels for use in a plant for the reprocessing of irradiated fuel. The holding or storage vessels must be resistant to the corrosive effect of nitric acid. The holding or storage vessels are normally fabricated of materials such as low carbon stainless steels, titanium or zirconium, or other high quality materials. Holding or storage vessels may be designed for remote operation and maintenance and may have the following features for control of nuclear criticality:

(1) walls or internal structures with a boron equivalent of at least two per cent, or

(2) a maximum diameter of 7 inches (17.78 cm) for cylindrical vessels, or

(3) a maximum width of 3 inches (7.62 cm) for either a slab or annular vessel.

C. Plutonium nitrate to plutonium oxide conversion systems - Complete systems especially designed or prepared for the conversion of plutonium nitrate to plutonium oxide, in particular adapted so as to avoid criticality and radiation effects and to minimise toxicity hazards.

D. Plutonium metal production systems - Complete systems especially designed or prepared for the production of plutonium metal, in particular adapted so as to avoid criticality and radiation effects and to minimise toxicity hazards.