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INFORMATION CIRCULAR

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 letters dated 2 March 1992 from the Resident Representatives to the Agency of Australia, Austria, Canada, Czechoslovakia, Denmark, Finland, the Federal Republic of Germany, Greece, Hungary, Ireland, Japan, Luxembourg, the Netherlands, Norway, Poland, Romania, Sweden, the United Kingdom of Great Britain and Northern Ireland, and the United States of America concerning the commitments of these Member States under Article III, paragraph 2, of the Treaty on the Non-Proliferation of Nuclear Weapons.

2. In the light of the wish expressed at the end of each letter, the text of the letters is attached hereto.

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LETTER

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

In the years since the procedures described in INFCIRC/209 were formulated for the export of certain categories of equipment and material especially designed or prepared for the processing, use or production of special fissionable material, developments in nuclear technology have brought the need to clarify parts of the Trigger List originally incorporated in Memorandum B of INFCIRC/209. Such clarifications have been covered in INFCIRC/209/Mods.1, 2, 3 and 4 and consolidated in INFCIRC/209/Rev.1.

My Government now thinks it desirable to clarify that part of the Trigger List which refers to plants for the production of heavy water, deuterium and deuterium compounds and equipment especially designed or prepared therefor. I therefore wish to inform you that Section 6 of the Annex to INFCIRC/209/Rev.1 (Clarification of Items on the Trigger List) now includes the text set out in the attachment to this letter.

As hitherto, my Government reserves the right to exercise discretion with regard to the interpretation and implementation of the procedures set out in the above mentioned documents and the right to control, if it wishes, the export of items relevant to the production of heavy water, deuterium and deuterium compounds other than those specified in the Annex to this letter.

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

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

INTRODUCTORY NOTE

Heavy water can be produced by a variety of processes. However, the two processes that have proven to be commercially viable are the water - hydrogen sulphide exchange process (GS process) and the ammonia - hydrogen exchange process.

The GS process is based upon the exchange of hydrogen and deuterium between water and hydrogen sulphide within a series of towers which are operated with the top section cold and the bottom section hot. Water flows down the towers while the hydrogen sulphide gas circulates from the bottom to the top of the towers. A series of perforated trays are used to promote mixing between the gas and the water. Deuterium migrates to the water at low temperatures and to the hydrogen sulphide at high temperatures. Gas or water, enriched in deuterium, is removed from the first stage towers at the junction of the hot and cold sections and the process is repeated in subsequent stage towers. The product of the last stage, water enriched up to 30% in deuterium, is sent to a distillation unit to produce reactor grade heavy water; i.e., 99.75% deuterium oxide.

The ammonia - hydrogen exchange process can extract deuterium from synthesis gas through contact with liquid ammonia in the presence of a catalyst. The synthesis gas is fed into exchange towers and then to an ammonia converter. Inside the towers the gas flows from the bottom to the top while the liquid ammonia flows from the top to the bottom. The deuterium is stripped from the hydrogen in the synthesis gas and concentrated in the ammonia. The ammonia then flows into an ammonia cracker at the bottom of the tower while the gas flows into an ammonia converter at the top. Further enrichment takes place in subsequent stages and reactor grade heavy water is produced through final distillation. The synthesis gas feed can be provided by an ammonia plant that, in turn, can be constructed in association with a heavy water ammonia-hydrogen exchange plant. The ammonia - hydrogen exchange process can also use ordinary water as a feed source of deuterium.

Many of the key equipment items for heavy water production plants using the GS or the ammonia - hydrogen exchange processes are common to several segments of the chemical and petroleum industries. This is particularly so for small plants using the GS process. However, few of the items are available "off-the-shelf". The GS and the ammonia - hydrogen processes require the handling of large quantities of flammable, corrosive and toxic fluids at elevated pressures. Accordingly, in establishing the design and operating standards for plants and equipment using these processes, careful attention to the materials selection and specifications is required to ensure long service life with high safety and reliability factors. The choice of scale is primarily a function of economics and need. Thus, most of the equipment items would be prepared according to the requirements of the customer.

Finally, it should be noted that, in both the GS and the ammonia - hydrogen exchange processes, items of equipment which individually are not especially designed or prepared for heavy water production can be assembled into systems which are especially designed or prepared for producing heavy water. The catalyst production system used in the ammonia - hydrogen exchange process and water distillation systems used for the final concentration of heavy water to reactor-grade in either process are examples of such systems.

The items of equipment which are especially designed or prepared for the production of heavy water utilizing either the water - hydrogen sulphide exchange process or the ammonia - hydrogen exchange process include the following:

6.1. Water - Hydrogen Sulphide Exchange Towers

Exchange towers fabricated from fine carbon steel (such as ASTM A516) with diameters of 6 m (20 ft) to 9 m (30 ft), capable of operating at pressures greater than or equal to 2 MPa (300 psi) and with a corrosion allowance of 6 mm or greater, especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process.

6.2. Blowers and Compressors

Single stage, low head (i.e., 0.2 MPa or 30 psi) centrifugal blowers or compressors for hydrogen-sulphide gas circulation (i.e., gas containing more than 70% H_2S) especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process. These blowers or compressors have a throughput capacity greater than or equal to 56 m^3/second (120,000 SCFM) while operating at pressures greater than or equal to 1.8 MPa (260 psi) suction and have seals designed for wet H_2S service.

6.3. Ammonia - Hydrogen Exchange Towers

Ammonia-hydrogen exchange towers greater than or equal to 35 m (114.3 ft) in height with diameters of 1.5 m (4.9 ft) to 2.5 m (8.2 ft) capable of operating at pressures greater than 15 MPa (2225 psi) especially designed or prepared for heavy water production utilizing the ammonia - hydrogen exchange process. These towers also have at least one flanged, axial opening of the same diameter as the cylindrical part through which the tower internals can be inserted or withdrawn.

6.4. Tower Internals and Stage Pumps

Tower internals and stage pumps especially designed or prepared for towers for heavy water production utilizing the ammonia-hydrogen exchange process. Tower internals include especially designed stage contactors which promote intimate gas/liquid contact. Stage pumps include especially designed submersible pumps for circulation of liquid ammonia within a contacting stage internal to the stage towers.

6.5. Ammonia Crackers

Ammonia crackers with operating pressures greater than or equal to 3 MPa (450 psi) especially designed or prepared for heavy water production utilizing the ammonia - hydrogen exchange process.

6.6. Infrared Absorption Analyzers

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

6.7. Catalytic Burners

Catalytic burners for the conversion of enriched deuterium gas into heavy water especially designed or prepared for heavy water production utilizing the ammonia - hydrogen exchange process.