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PART 1 OF 2

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GOVERNMENT NOTICES

DEPARTMENT OF TRADE AND INDUSTRY

No. 74

18 February 2015

NOTICE OF AMENDMENT

1. By virtue of the powers vested in me in terms of section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), I Rob Davies, Minister of Trade and Industry, hereby –

(a) amend Notice No. 18 of 3 February 2010 as indicated in the Schedule hereto; and

(b) determine that –

(i) words in bold type in square brackets indicate omissions from existing enactments;

(ii) words underlined with a solid line indicate insertions in existing enactments; and

(iii) the amendments will become operative on the date of publication of this Notice of Amendment.

2. Notice No. 18 of 3 February 2010 as amended (incorporating the amendments indicated in the Schedule hereto) is available on **the dti** website: www.thedti.gov.za/nonproliferation



DR ROB DAVIES, MP

MINISTER OF TRADE AND INDUSTRY

DATE: 26/1/15

SCHEDULE**[GOVERNMENT NOTICE]****DEPARTMENT OF TRADE AND INDUSTRY****GOVERNMENT NOTICE****No. 18****3 February 2010****PUBLISHED IN TERMS OF THE NON-PROLIFERATION OF WEAPONS OF MASS
DESTRUCTION ACT, 1993 (ACT NO. 87 OF 1993), AS AMENDED**

Please note: Although there are many amendments, their nature does not justify the repeal of the current Notice. Therefore, the number and year date of the amended Notice remain the same. A new number and year date have been allocated to the Notice of Amendment. Text that has been deleted is shown in bold between square brackets, [], while new insertions are underlined. Stakeholders can access a "clean amended version" (incorporating all amendments) through the website of the Council.

**DECLARATION OF CERTAIN CHEMICAL GOODS AS CONTROLLED GOODS
AND CONTROL MEASURES APPLICABLE TO SUCH GOODS****Declaration**

1. I, Dr Rob Davies, Minister of Trade and Industry, under section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), and on the recommendation of the South African Council for the Non-Proliferation of Weapons of Mass Destruction, hereby declare the goods listed in paragraph 4 of, and in the annexures to, this notice to be controlled goods.

2. I hereby—
 - (a) in terms of section 13(2)(e) of the Act and pursuant to South Africa's

obligations under the Chemical Weapons Convention, prohibit—

- (i) the development, production, acquisition, stockpiling or retention of chemical weapons or the transfer, whether direct or indirect, of chemical weapons to any person;
 - (ii) the use of chemical weapons;
 - (iii) engagement in any military preparations to use chemical weapons;
 - (iv) the assistance, encouragement or induction, in any way, of any person to engage in any activity prohibited under the Chemical Weapons Convention;
 - (v) the use of riot control agents as a method of warfare; and
 - (vi) the export or re-export of the toxic chemicals or precursors listed in Annexures A and B, whether in substantially pure form or in a mixture with any other substance, to countries which are not States Parties to the Chemical Weapons Convention;
- (b) in terms of section 13(2)(b) of the Act, determine that the import, export, re-export or transit (including transshipment) of the controlled goods, as listed in Annexures A, B and C and **[Part A of]** Annexure E to this notice, shall take place under a permit issued by the Council: A permit is not required for quantities of 5 milligrams or less of saxitoxin, if the transfer is made for medical or diagnostic purposes, in which case a notification to that effect shall be made to the Council before the transfer;
- (c) in terms of section 13(2)(b) of the Act, determine that the transit (including transshipment), export or re-export of the controlled goods, as listed in Annexure D, **[Part B of Annexure E]** and Annexure F to this notice, shall take place under a permit issued by the Council;
- (d) in terms of section 13(2)(b) of the Act, determine that the internal (intranational) transfer of chemicals listed in Annexure A to this notice, shall take place under a permit issued by the Council;

- (e) in terms of section 13(2)(c) of the Act, determine that the Council may require a State-to-State assurance or an end-user or end-use certificate for the export or re-export of the controlled goods listed in the annexures to this notice;
- (f) in terms of section 13(2)(c) of the Act, determine that the Council shall require an end-user or end-use certificate for the export or re-export of the controlled goods listed in Annexure C to this notice, whether in substantially pure form or in a mixture with any other substance in a concentration of greater than or equal to 30 per cent by weight, to countries which are not States Parties to the Chemical Weapons Convention; **[and]**
- (g) in terms of section 13(2)(f) of the Act, determine that the manufacture of, and provision of services with respect to, controlled goods listed in Annexure A to this notice shall take place under a permit issued by the Council; and
- (h) in terms of section 13(3)(b) of the Act determine that the Council should, not less than 60 days before the transfer of controlled goods listed in Annexure A to or from another State Party, be notified of the transfer.

Definitions

3. In this notice any word or expression to which a meaning has been assigned in the Act or the Chemical Weapons Convention, as the case may be, shall have the meaning so assigned and, unless the context otherwise indicates—

"antiplant agent" means any chemical listed in Annexure F to this notice, which can defoliate plants or which can destroy crops or plants or which can sterilise the soil to prevent plant growth;

"Chemical Weapons Convention" means the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, as ratified by the Government of the Republic of South Africa on 14 September 1995 and published for general information as Government Notice No. 754 on 2 May 1997;

"**development**" means all phases before production, and includes conceptualisation, research, analysis, testing, configuration or pilot production schemes;

"**discrete organic chemical**" means any chemical belonging to a class of chemical compounds consisting of all compounds of carbon, except for its oxides, sulphides and metal carbides or carbonates, identifiable by chemical structure, by structural formula, if known, and by the Chemical Abstracts Service (CAS) registry number, if assigned, and not contained in the chemicals listed in Annexures A, B or C to this notice;

[**"harassing agent"**] "**riot control agent**" means any toxic chemical, which is not among the toxic chemicals listed in Annexures A, B, C or D to this notice, which can produce rapidly in humans sensory irritation or disabling physical effects, which disappear within a short time following the termination of exposure;

"**manufacture**", in relation to a chemical, includes development and production;

"precursor" means any chemical reactant which takes part at any stage in the production by whatever method of a toxic chemical. This includes any key component of a binary or multicomponent chemical system;

"**PSF discrete organic chemical**" means any discrete organic chemical containing one or more of the elements phosphorus, sulphur or fluorine;

"purposes not prohibited under the Chemical Weapons Convention" means

- (a) Industrial, agricultural, research, medical, pharmaceutical or other peaceful purposes;
- (b) Protective purposes, namely those purposes directly related to protection against toxic chemicals and to protection against chemical weapons;
- (c) Military purposes not connected with the use of chemical weapons and not dependent on the use of the toxic properties of chemicals as a method of warfare;
- (d) Law enforcement including domestic riot control purposes;

"**services**" includes freight forwarding, storing and stockpiling (if not part of the manufacture and transfer processes), transporting, maintaining (repairing,

overhauling, refurbishing), trading, consulting, disposing, and technical assistance;

"toxic chemical" means any chemical which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere;

"the Act" means the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993);

"transfer" means the change of ownership or custodianship or change in the location of controlled goods, whether or not they cross an international border; and

"use", in relation to a chemical, means the depletion of reserves by adding a chemical to formulations, as a constituent in a mixture, in a scrubber of unwanted chemicals, as a starting material in a process, as a component of a reaction or as a catalyst.

Controlled goods

4. The following goods are controlled goods at the control thresholds indicated in paragraph 5 of this notice:

- (a) The toxic chemicals and precursors listed in Annexures A, B and C, which may be used for purposes that are not prohibited as indicated in paragraph 9 of Article II of the Chemical Weapons Convention: Provided that the types and quantities are consistent with such purposes, whether in substantially pure form or in a mixture. Whenever, in Annexures A and B, reference to groups of dialkylated chemicals is followed by a list of alkyl groups in parentheses, all chemicals possible by all possible combinations of alkyl groups listed in the parentheses are considered to be controlled goods, except those explicitly exempted in Annexure B;
- (b) the toxic chemicals listed in Annexure D, whether in substantially pure form or in a mixture;

- (c) the **[harassing and]** riot control agents listed in Annexure E, whether in substantially pure form or in a mixture, except—
- (i) goods containing capsaicin packaged for retail sale for personal use or packaged for individual use; and
 - (ii) goods containing **[harassing or]** riot control agents packaged for food production or medical purposes;
- (d) the antiplant agents listed in Annexure F, whether in substantially pure form or in a mixture;
- (e) any chemical facility that produces, acquires, consumes or stores any quantity of the toxic chemicals and precursors listed in Annexure A. As indicated in paragraph 8 of Part VI of the Verification Annex of the Chemical Weapons Convention, the production of the toxic chemicals and precursors listed in Annexure A shall only be carried out at a single small-scale facility. The toxic chemicals and precursors shall only be applied for research, medical, pharmaceutical or protective purposes, and the aggregate amount of such chemicals for such purposes at any given time should be less than or equal to one metric tonne;
- (f) any chemical facility that produced, processed or consumed during the previous calendar year or anticipates to produce, process or consume in the next calendar year 10 grams or more of the toxic chemical BZ listed in Annexure B, one kilogram or more of the toxic chemicals Amiton or PFIB listed in Annexure B or 10 kilograms or more of any precursor listed in Annexure B;
- (g) any chemical facility that produced during the previous calendar year or anticipates to produce in the next calendar year 100 kilograms or more of any toxic chemical listed in Annexure C;
- (h) any chemical facility that produced by chemical synthesis **[including biochemical or biologically mediated processes]**, an aggregate

quantity of 100 metric tonnes or more of any number of discrete organic chemicals or their salts, or an aggregate quantity of 15 metric tonnes or more of any single PSF discrete organic chemical or its salts, during the previous calendar year. For the purposes of this paragraph, polymeric and oligomeric substances are not regarded as discrete organic chemicals. For the purposes of this paragraph, chemical facilities that—

- (i) produce explosives or hydrocarbons exclusively, are exempted;
 - (ii) produce polymeric and oligomeric substances exclusively, are exempted;
 - (iii) produce any discrete organic chemicals or PSF discrete organic chemicals, as well as hydrocarbons, explosives or polymeric and oligomeric substances, are not exempted; and
 - (iv) process chemicals or blend or formulate chemicals into products such as insecticides, paints or detergents, where no chemical reactions take place, are exempted;
- (i) the technology required for the production of the controlled goods listed in Annexure A and the toxic chemicals listed in Annexure B; and
- (j) services with regard to the controlled goods listed in Annexure A.

Control thresholds

5. (1) The control thresholds of controlled goods for the purposes of declarations shall be as follows:

- (a) All quantities of the toxic chemicals and precursors listed in Annexure A, whether in substantially pure form or in a mixture with any other substance;
- (b) an aggregate quantity per calendar year of—

- (i) the toxic chemical BZ listed in Annexure B greater than or equal to 10 grams, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to one per cent by weight;
 - (ii) the toxic chemicals Amiton and PFIB listed in Annexure B greater than or equal to one kilogram, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to one per cent by weight; or
 - (iii) the precursors listed in Annexure B greater than or equal to 10 kilograms, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;
- (c) an aggregate quantity per calendar year of the toxic chemicals and precursors listed in Annexure C greater than or equal to 100 kilograms, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;
- (d) an aggregate quantity per calendar year of all discrete organic chemicals or their salts produced within a chemical plant site greater than or equal to 100 metric tonnes in substantially pure form;
- (e) an aggregate quantity per calendar year of all PSF discrete organic chemicals or their salts produced within a chemical facility greater than or equal to 15 metric tonnes in substantially pure form;
- (f) an aggregate quantity per calendar year of the toxic chemicals listed in Annexure D greater than or equal to one metric tonne, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;

(g) an aggregate quantity per calendar year of the riot control agents listed in **[Part A of]** Annexure E greater than or equal to 100 kilograms, whether in substantially pure form or in a mixture with any other substance, except in products identified as consumer goods packaged for retail sale for personal use or packaged for individual use; and

[(h) any quantity per calendar year of the harassing agents listed in Part B of Annexure E, whether in substantially pure form or in a mixture with any other substance, except in products identified as consumer goods packaged for retail sale for personal use or packaged for individual use; and]

[(i)h] any quantity per calendar year of the antiplant agents listed in Annexure F, whether in substantially pure form or in a mixture with any other substance.

(2) For the purposes of subparagraphs (1)(a), (b) and (c), all threshold quantities shall include quantities of controlled chemicals generated as by-products or as components of waste or effluent streams in a chemical production process.

(3) The control thresholds of controlled goods for the purposes of transfers shall be as follows:

(a) All quantities of the toxic chemicals and precursors listed in Annexure A, whether in substantially pure form or in a mixture with any other substance;

(b) All quantities of toxic chemicals and precursors listed in Annexure B

(i) the toxic chemical BZ listed in Annexure B whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to one per cent by weight;

(ii) the toxic chemicals Amiton and PFIB listed in Annexure B whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to one per cent by weight;
or

- (iii) the precursors listed in Annexure B whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;

- (c) an aggregate quantity of the toxic chemicals and precursors listed in Annexure C greater than or equal to 25 kilograms, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;

- (d) an aggregate quantity of the toxic chemicals listed in Annexure D greater than or equal to 100 kilograms, whether in substantially pure form or in a mixture with any other substance in a concentration greater than or equal to 30 per cent by weight;

- (e) any quantity of the riot control agents listed in Annexure E, whether in substantially pure form or in a mixture with any other substance, except in products identified as consumer goods packaged for retail sale for personal use or packaged for individual use; and

- (f) any quantity of the antiplant agents listed in Annexure F, whether in substantially pure form or in a mixture with any other substance.

([3]4) Products containing chemicals listed in Annexure B may be exported to countries that are not States Parties to the Chemical Weapons Convention: Provided that the said products contain—

- (a) one per cent or less of the toxic chemicals listed in Annexure B; or

- (b) 10 per cent or less of the precursors listed in Annexure B; and

are identified as consumer goods packaged for retail sale for personal use or packaged for individual use.

([4]5) Products containing chemicals listed in Annexure C may be exported without a

permit to countries that are not States Parties to the Chemical Weapons Convention: Provided that the said products contain less than 30 per cent of a chemical listed in Annexure C and are identified as consumer goods packaged for retail sale for personal use or packaged for individual use.

Application forms

6. Application forms for permits contemplated in paragraph 2 of this notice may be obtained from any of the following addresses:

(a) Postal address:

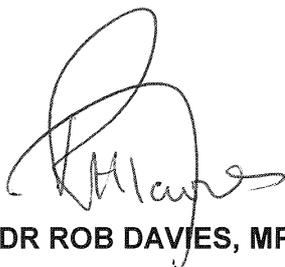
The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
Private Bag X84
PRETORIA
0001; or

(b) Physical address:

The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
77 Meintjies Street
Sunnyside
PRETORIA.

Repeal

7. Government Notice No. 152 of 29 January 2003 is hereby repealed.



DR ROB DAVIES, MP

MINISTER OF TRADE AND INDUSTRY

DATE: 26/1/15

ANNEXURE A**Schedule 1 of the Chemical Weapons Convention**

(Chemical Abstracts Service
Registry Number)

A. Toxic chemicals:

- (1) O-Alkyl (equal to or less than C₁₀, including cycloalkyl) alkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-phosphonofluoridates, such as

Sarin: O-Isopropyl methylphosphonofluoridate (107-44-8)

Soman: O-Pinacolyl methylphosphonofluoridate (96-64-0)

- (2) O-Alkyl (equal to or less than C₁₀, including cycloalkyl) N,N-Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidocyanidates, such as

Tabun: O-Ethyl N,N-dimethylphosphoramidocyanidate (77-81-6)

- (3) O-Alkyl (H or equal to or less than C₁₀, including cycloalkyl) S-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonothiolates and corresponding alkylated or protonated salts, such as

VX: O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate (50782-69-9)

- (4) Sulphur mustards:
2-Chloroethylchloromethylsulphide (2625-76-5)

- | | | |
|-----------|---|---------------|
| | Mustard gas: Bis(2-chloroethyl)sulphide | (505-60-2) |
| | Bis(2-chloroethylthio)methane | (63869-13-6) |
| | Sesquimustard: 1,2-Bis(2-chloroethylthio)ethane | (3563-36-8) |
| | 1,3-Bis(2-chloroethylthio)-n-propane | (63905-10-2) |
| | 1,4-Bis(2-chloroethylthio)-n-butane | (142868-93-7) |
| | 1,5-Bis(2-chloroethylthio)-n-pentane | (142868-94-8) |
| | Bis(2-chloroethylthiomethyl)ether | (63918-90-1) |
| | O-Mustard: Bis(2-chloroethylthioethyl)ether | (63918-89-8) |
| (5) | Lewisites: | |
| | Lewisite 1: 2-Chlorovinylchloroarsine | (541-25-3) |
| | Lewisite 2: Bis(2-chlorovinyl)chloroarsine | (40334-69-8) |
| | Lewisite 3: Tris(2-chlorovinyl)arsine | (40334-70-1) |
| (6) | Nitrogen mustards: | |
| | HN1: Bis(2-chloroethyl)ethylamine | (538-07-8) |
| | HN2: Bis(2-chloroethyl)methylamine | (51-75-2) |
| | HN3: Tris(2-chloroethyl)amine | (555-77-1) |
| (7) | Saxitoxin | (35523-89-8) |
| (8) | Ricin | (9009-86-3) |
| B. | Precursors: | |
| (9) | Alkyl (Methyl, Ethyl, n-Propyl or Isopropyl)
phosphonyl-difluorides, such as | |
| | DF: Methylphosphonyldifluoride | (676-99-3) |
| | Ethylphosphonyl difluoride | (753-98-0) |
| (10) | O-Alkyl (H or equal to or less than C ₁₀ , including
cycloalkyl) O-2-dialkyl (Methyl, Ethyl, n-Propyl
or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, | |

n-Propyl or Isopropyl) phosphonites and corresponding alkylated or protonated salts, such as

- QL: O-Ethyl O-2-diisopropylaminoethyl Methylphosphonite (57856-11-8)
- (11) Chlorosarin:
O-Isopropyl methylphosphono-chloridate (1445-76-7)
- (12) Chlorosoman:
O-Pinacolyl methylphosphono-chloridate (7040-57-5)

ANNEXURE B**Schedule 2 of the Chemical Weapons Convention**(Chemical Abstracts Service
Registry Number)**A. Toxic chemicals:**

- (1) Amiton:
O,O-Diethyl S-[2-(diethylamino) ethyl] phosphorothiolate
and corresponding alkylated or protonated salts (78-53-5)
- (2) PFIB:
1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8)
- (3) BZ:
3-Quinuclidinyl benzilate (6581-06-2)

B. Precursors:

- (4) Chemicals, except for those listed in Schedule 1,
containing a phosphorus atom to which is bonded
one methyl, ethyl or propyl (normal or iso) group
but not further carbon atoms, such as
- Methylphosphonyl dichloride (676-97-1)
- Dimethyl methylphosphonate (756-79-6)
- Diethyl ethylphosphonate (78-38-6)
- Ethylphosphinyl dichloride (1498-40-4)
- Ethylphosphonyl dichloride (1066-50-8)
- Methylphosphinyl dichloride (676-83-5)
- Ethylphosphinyl difluoride (430-78-4)
- Methylphosphinyl difluoride (753-59-3)
- Methylphosphonic acid (993-13-5)
- Methylphosphonothioic dichloride (676-98-2)

	Diethyl methylphosphonite	(15715-41-0)
	Dimethyl ethylphosphonate	(6163-75-3)
	Exemption:	
	Fonofos:	
	O-Ethyl S-phenyl ethylphosphonothiolothionate	(944-22-9)
(5)	N,N-Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidic dihalides	
(6)	Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl N,N-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-phosphoramidates, such as	
	Diethyl N,N-dimethylphosphoramidate	(2404-03-7)
(7)	Arsenic trichloride	(7784-34-1)
(8)	2,2-Diphenyl-2-hydroxyacetic acid (Benzilic acid)	(76-93-7)
(9)	Quinuclidin-3-ol	(1619-34-7)
(10)	N,N-Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) aminoethyl-2-chlorides and corresponding protonated salts, such as	
	N,N-Diisopropyl-(beta)-aminoethyl chloride	(96-79-7)
	N,N-Diisopropyl-2-aminoethyl chloride hydrochloride	(4261-68-1)
	N,N-Dimethylaminophosphoryl dichloride	(676-98-2)
(11)	N,N-Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) aminoethane-2-ols and corresponding protonated salts, such as	

N,N-Diisopropyl-(beta)-aminoethanol (96-80-0)

Exemptions:

N,N-Dimethylaminoethanol (108-01-0)

and corresponding protonated salts

Protonated salts of N,N-Diethylaminoethanol (100-37-8)

- (12) N,N-Dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) aminoethane-2-thiols and corresponding protonated salts, such as

N,N-Diisopropyl-(beta)-aminoethane thiol (5842-07-9)

- (13) Thiodiglycol:

Bis(2-hydroxyethyl)sulphide (111-48-8)

- (14) Pinacolyl alcohol:

3,3-Dimethylbutan-2-ol (464-07-3)

ANNEXURE C**Schedule 3 of the Chemical Weapons Convention**(Chemical Abstracts Service
Registry Number)**A. Toxic chemicals:**

- | | | |
|-----|-------------------------------------|------------|
| (1) | Phosgene: Carbonyl dichloride | (75-44-5) |
| (2) | Cyanogen chloride | (506-77-4) |
| (3) | Hydrogen cyanide | (74-90-8) |
| (4) | Chloropicrin: Trichloronitromethane | (76-06-2) |

B. Precursors:

- | | | |
|------|--------------------------|--------------|
| (5) | Phosphorus oxychloride | (10025-87-3) |
| (6) | Phosphorus trichloride | (7719-12-2) |
| (7) | Phosphorus pentachloride | (10026-13-8) |
| (8) | Trimethyl phosphite | (121-45-9) |
| (9) | Triethyl phosphate | (122-52-1) |
| (10) | Dimethyl phosphite | (868-85-9) |
| (11) | Diethyl phosphite | (762-04-9) |
| (12) | Sulphur monochloride | (10025-67-9) |
| (13) | Sulphur dichloride | (10545-99-0) |

- | | | |
|------|----------------------|-------------|
| (14) | Thionyl chloride | (7719-09-7) |
| (15) | Ethyldiethanolamine | (139-87-7) |
| (16) | Methyldiethanolamine | (105-59-9) |
| (17) | Triethanolamine | (102-71-6) |

ANNEXURE D

(Chemical Abstracts Service
Registry Number)

Toxic chemicals:

- | | | |
|------|------------------------------|-------------|
| (1) | 3-Hydroxy-1-methylpiperidine | (3554-74-3) |
| (2) | Potassium fluoride | (7789-23-3) |
| (3) | 2-Chloroethanol | (107-07-3) |
| (4) | Dimethylamine | (124-40-3) |
| (5) | Dimethylamine hydrochloride | (506-59-2) |
| (6) | Hydrogen fluoride | (7664-39-3) |
| (7) | Methyl benzilate | (76-89-1) |
| (8) | 3-Quinuclidone | (3731-38-2) |
| (9) | Pinacolone | (75-97-8) |
| (10) | Potassium cyanide | (151-50-8) |
| (11) | Potassium bifluoride | (7789-29-9) |
| (12) | Ammonium bifluoride | (1341-49-7) |
| (13) | Sodium bifluoride | (1333-83-1) |
| (14) | Sodium fluoride | (7681-49-4) |
| (15) | Sodium cyanide | (143-33-9) |

(16)	Phosphorus pentasulphide	(1314-80-3)
(17)	Di-isopropylamine	(108-18-9)
(18)	Diethylaminoethanol	(100-37-8)
(19)	Sodium sulphide	(1313-82-2)
(20)	Triethanolamine hydrochloride	(637-39-8)
(21)	Triisopropyl phosphite	(116-17-6)
(22)	O,O-Diethyl phosphorothioate	(2465-65-8)
(23)	O,O-Diethyl phosphorodithioate	(298-06-6)
(24)	Sodium hexafluorosilicate	(16893-85-9)

ANNEXURE E

(Chemical Abstracts Service
Registry Number)

[A.] Riot Control Agents

Riot control agents including the following:

- (1) α -Bromobenzeneacetonitrile,
(Bromobenzyl cyanide), (CA) (5798-79-8)
- (2) 2-Chloro-1-phenyl-ethanone, (Phenylacetyl chloride),
(ω -chloroacetophenone), (CN) (532-27-4)
- (3) [(2-chlorophenyl)-methylene] propanedinitrile,
(*o*-Chlorobenzylidenemalonitrile), (CS) (2698-41-1)
- (4) Dibenz(b,f)-1,4-oxazepine, (CR) (257-07-8)

[B. Harassing Agents

Harassing agents including the following:]

- ([1]5) Diphenylaminochloroarsine, (10-Chloro-5,10-dihydrophen-
arsazine), (Phenarsazine chloride), (Adamsite), (DM) (578-94-9)
- ([2]6) N-nonanylmorpholine, (MPA) (5299-64-9)
- ([3]7) trans-8-Methyl-N-vanillyl-6-nonenamide, (Capsaicin), (Pepper
Spray), [N-(4-hydroxy-3-methoxy benzyl)-8-methyl-non-trans-6-enamide],
(404-86-4)
- ([4]8) Ethyl bromoacetate, (EBA) (105-36-2)
- ([5]9) Pelargonic acid vanillylamide (2444-46-4)

- (~~[6]~~10) Phenyl chloride (108-90-7)
- (~~[7]~~11) Mixture of OC and CS
- (12) Oleoresin capsicum (OC) (8023-77-6)
- (13) 8-Methyl-N-vanillynonamide
(dihydrocapsaicin) (19408-84-5)
- (14) N-Vanillyl-9-methyldec-7-(E)-enamide
(homocapsaicin) (58493-48-4)
- (15) N-Vanillyl-9-methyldecanamide
(homodihydrocapsaicin) (20279-06-5)
- (16) N-Vanillyl-7-methyloctanamide
(nordihydrocapsaicin) (28789-35-7)
- (17) 2'-Chloroacetophenone (2142-68-9)
- (18) 3'-Chloroacetophenone (99-02-5)
- (19) α -Chlorobenzylidenemalononitrile (18270-61-6)
- (20) Cis-4-acetylamino-dicyclohexylmethane (37794-87-9)
- (21) N,N'-Bis(isopropyl)ethylenediimine (E,E 28227-41-0; Z,Z 185245-09-4)
- (22) N,N'-Bis(tert-butyl)ethylenediimine (30834-74-3; E,E 28227-42-1)

ANNEXURE F

(Chemical Abstracts Service
Registry Number)

Anti-plant agents:

Anti-plant agents as follows:

- | | | |
|-----|---|-------------|
| (1) | Butyl 2-chloro-4-fluorophenoxyacetate (LNF) | (1692-85-9) |
| (2) | Mixtures of 2,4,5-T and 2,4-D where: | |
| | 2,4,5-T: 2,4,5-Trichlorophenoxyacetic acid | (93-76-5) |
| | 2,4-D: 2,4-Dichlorophenoxyacetic acid | (94-75-7) |
| (3) | Mixtures of Picloram where: | |
| | Picloram: 4-Amino-3,5,6-trichloropicolinic acid | (1918-02-1) |
| (4) | Dimethylarsinic acid (Cacodylic acid) | (75-60-5) |

No. 75

18 February 2015

DEPARTMENT OF TRADE AND INDUSTRY

NOTICE OF AMENDMENT

1. By virtue of the powers vested in me in terms of section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), I Rob Davies, Minister of Trade and Industry, hereby –

(a) amend Notice No. 19 of 3 February 2010 as indicated in the Schedule hereto; and

(b) determine that –

- (i) words in bold type in square brackets indicate omissions from existing enactments;
- (ii) words underlined with a solid line indicate insertions in existing enactments; and
- (iii) the amendments will become operative on the date of publication of this Notice of Amendment.

2. Notice No. 19 of 3 February 2010 as amended (incorporating the amendments indicated in the Schedule hereto) is available on **the dti** website: www.thedti.gov.za/nonproliferation



DR ROB DAVIES, MP

MINISTER OF TRADE AND INDUSTRY

DATE: 26/1/15

SCHEDULE**[GOVERNMENT NOTICE]****DEPARTMENT OF TRADE AND INDUSTRY****GOVERNMENT NOTICE**

No. 19

3 February 2010

PUBLISHED IN TERMS OF THE NON-PROLIFERATION OF WEAPONS OF MASS DESTRUCTION ACT, 1993 (ACT NO. 87 OF 1993), AS AMENDED

Please note: Although there are many amendments, their nature does not justify the repeal of the current Notice. Therefore, the number and year date of the amended Notice remain the same. A new number and year date have been allocated to the Notice of Amendment. Text that has been deleted is shown in bold between square brackets, [], while new insertions are underlined. Stakeholders can access a "clean amended version" (incorporating all amendments) through the website of the Council.

DECLARATION OF CERTAIN BIOLOGICAL GOODS AND TECHNOLOGIES AS CONTROLLED GOODS AND CONTROL MEASURES APPLICABLE TO SUCH GOODS**Declaration**

1. I, Dr Rob Davies, Minister of Trade and Industry, under section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), and on the recommendation of the South African Council for the Non-Proliferation of Weapons of Mass Destruction, hereby declare microbial or other biological agents, toxins and related equipment and technology that may be used in the manufacture of biological and toxin weapons as listed in Annexures A and B to this notice, to be controlled goods.

2. I hereby—

- (a) in terms of section 13(2)(a) and (e) of the Act and pursuant to South Africa's obligations under the Biological and Toxin Weapons Convention, further prohibit—
- (i) the import, export, re-export, transit (including transshipment), possession, development, manufacture, production, acquisition in any manner, use, operation, stockpiling, maintenance, transport, disposal, sale, and retention of biological weapons;
 - (ii) any person to assist, encourage or to induce any State, group of States, international organisations or non-State actors to manufacture or otherwise acquire biological weapons;
- (b) in terms of section 13(2)(b) of the Act, determine that the export, re-export or transit (including transshipment) of controlled goods listed in the annexures to this notice, shall take place under a permit issued by the Council;
- (c) in terms of section 13(2)(c) of the Act, determine that the Council may require a State-to-State assurance or an end-user or end-use certificate for the export or re-export of controlled goods listed in the annexures to this notice; and
- (d) in terms of section 13(2)(d) of the Act, determine that all transport of controlled goods within the Republic of South Africa be declared to the Council within 21 calendar days of such transportation.

Definitions

3. In this notice any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned and, unless the context otherwise indicates—

"Biological and Toxin Weapons Convention" means the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, added as a schedule to the Act;

"biological weapons" means microbial or other biological agents or toxins, regardless of the origin or method of production thereof, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes, and weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict;

"development" means all phases before production, and includes conceptualisation, research, analysis, testing, configuration or pilot production schemes;

"services" includes freight forwarding, storing and stockpiling (if not part of the manufacture and transfer processes), transporting, maintaining (repairing, overhauling, refurbishing), trading, consulting, disposing, and technical assistance;

"the Act" means the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993);

"transfer" means the change of ownership or custodianship, or change in the location, of controlled goods, whether or not they cross an international border.

Application forms

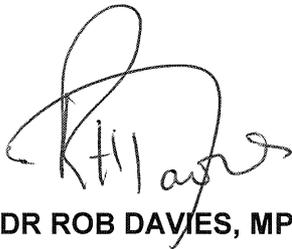
4. Application forms for permits contemplated in paragraph 2 of this notice can be obtained from any of the following addresses:

- (a) Postal address:
The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
Private Bag X84
PRETORIA
0001; or

- (b) Physical address:
The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
77 Meintjies Street
Sunnyside
PRETORIA.

Repeal

5. Government Notice No. 712 of 8 June 2004 is hereby repealed.



DR ROB DAVIES, MP

MINISTER OF TRADE AND INDUSTRY

26/1/15

ANNEXURE A**I. HUMAN PATHOGENS, ZOOSES AND TOXINS, AS FOLLOWS:**

- a. Viruses, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
- Chikungunya virus;
 - Eastern equine encephalitis virus;
 - Western equine encephalitis virus;
 - Venezuelan equine encephalitis virus;
 - Oropouche virus;
 - Rocio virus;
 - Dengue fever virus;
 - Yellow fever virus;
 - Japanese encephalitis virus;
 - Tick-borne encephalitis complex viruses, including Russian Spring-Summer encephalitis, Kyasanur Forest, Louping ill, Omsk haemorrhagic fever and Powassan;
 - St Louis encephalitis virus;
 - Murray Valley encephalitis virus;
 - Rift Valley fever virus;

- Crimean-Congo haemorrhagic fever virus;
 - Hantaviruses, including Hantaan, Seoul, Dobrava, Puumala and Sin Nombre;
 - Arenaviruses, associated with haemorrhagic fevers including Lassa fever, Junin, Machupo, Lymphocytic choriomeningitis, Sabia, Flexal, Dandenong, Lujo and Guanarito;
 - Variola virus;
 - Monkey pox virus;
 - Ebola virus;
 - Marburg virus;
 - Hendra virus;
 - Nipah virus.
- b. Rickettsiae, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
- Coxiella burnetii;
 - Bartonella quintana (Rochalimaea quintana, Rickettsia quintana);
 - Rickettsia prowazekii;
 - Rickettsia rickettsii.
- c. Bacteria, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material

which has been deliberately inoculated or contaminated with such cultures, as follows:

- *Bacillus anthracis*;
- *Brucella abortus*;
- *Brucella melitensis*;
- *Brucella suis*;
- *Chlamydia psittaci*;
- *Clostridium botulinum*;
- *Clostridium perfringens*, epsilon toxin producing types;
- *Clostridium tetani*;
- Enterohaemorrhagic *Escherichia coli*, serotype 0157 and other verotoxin producing serotypes;
- *Francisella tularensis*;
- *Legionella pneumophila*;
- *Burkholderia mallei* (*Pseudomonas mallei*);
- *Burkholderia pseudomallei* (*Pseudomonas pseudomallei*);
- *Salmonella typhi*;
- *Shigella dysenteriae*;
- *Vibrio cholerae*;

- *Yersinia pestis*;
- *Yersinia pseudotuberculosis*.

d. Toxins, as follows, and subunits of toxins thereof:

- Abrin;
- Botulinum toxins;
- Cholera toxin;
- *Clostridium perfringens* toxins;
- Conotoxin;
- Modeccin;
- Ricin;
- Saxitoxin;
- Shiga toxin;
- *Staphylococcus aureus* toxins;
- Tetanus toxin;
- Tetrodotoxin;
- Trichothecene mycotoxins, such as T-2 toxin, HT-2 toxin and Diacetoxyscirpenol toxin;
- Verotoxin;
- Microcystin (Cyanginosin);

- Aflatoxin;
- Volkensin;
- Viscum album Lectin 1 (Viscumin);

except:

Any goods [**specified in (ic)**] in the form of a vaccine or toxoid.

e. Fungi, as follows:

- *Coccidioides immitis*;
- *Coccidioides posadasii*.

II. ANIMAL PATHOGENS, AS FOLLOWS:

a. Viruses, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

- African swine fever virus;
- African horsesickness virus;
- Avian influenza virus, which can be:
 1. Uncharacterised; or
 2. Defined as having high pathogenicity, as follows:
 - i. Type A viruses with an IVPI (intravenous pathogenicity index) in six-week-old chickens of greater than 1.2; or

- ii. Type A viruses, H5 or H7 subtype, for which nucleotide sequencing has demonstrated multiple basic amino acids at the cleavage site of haemagglutinin;
- Bluetongue virus;
 - Foot-and-mouth disease virus;
 - Goat pox virus;
 - Porcine herpesvirus (Aujeszky's disease);
 - Swine fever virus (Hog cholera virus);
 - Lyssaviruses;
 - Newcastle disease virus;
 - 'Peste des petits ruminants' virus;
 - Porcine enterovirus type 9 (swine vesicular disease virus);
 - Rinderpest virus;
 - Sheep pox virus;
 - Teschen disease virus;
 - Vesicular stomatitis virus;
 - Lumpy skin disease.
- b. *Mycoplasma mycoides* subspecies *mycoides* SC (small colony), whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material which has been deliberately inoculated or contaminated with such *Mycoplasma mycoides* (*mycoides* SC).

- c. *Mycoplasma capricolum* subspecies *capripneumoniae* ("strain F38")

except:

Any goods [specified in (ic)] in the form of a vaccine or toxoid.

III. GENETICALLY MODIFIED MICRO-ORGANISMS, AS FOLLOWS:

- a. Genetically modified micro-organisms or genetic elements that contain nucleic acid sequences associated with pathogenicity of organisms specified in (I.a) to (I.c) or (II) or (IV).
- b. Genetically modified micro-organisms or genetic elements that contain nucleic acid sequences coding for any of the toxins specified in (I.d) or subunits of toxins thereof.

IV. PLANT PATHOGENS, AS FOLLOWS:

- a. Bacteria, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material which has been deliberately inoculated or contaminated with such cultures, as follows:
- *Xanthomonas albilineans*;
 - *Xanthomonas campestris* pv. *citri*, including strains referred to as *Xanthomonas campestris* pv. *citri* types A, B, C, D, E or otherwise classified as *Xanthomonas citri*, *Xanthomonas campestris* pv. *aurantifolia*, *Xanthomonas campestris* pv. *citrumelo*, *Xanthomonas axonopodis* pv. *citri*, *Xanthomonas axonopodis* pv. *citrumelo*, *Xanthomonas axonopodis* pv. *aurantifolii*;
 - *Xanthomonas oryzae* pv. *oryzae*;
 - *Xylella fastidiosa*;
 - *Clavibacter michiganensis* subspecies *sepedonicus* (*Corynebacterium michiganensis* subspecies *sepedonicum* or *Corynebacterium sepedonicum*);

- *Ralstonia solanacearum* races 2 and 3 (*Pseudomonas solanacearum* races 2 and 3 or *Burholderia solanacearum* races 2 and 3).
- b. Fungi, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material which has been deliberately inoculated or contaminated with such cultures, as follows:
- *Colletotrichum kahawae* (*Colletotrichum coffeanum* var. *virulans*);
 - *Cochliobolus miyabeanus* (*Helminthosporium oryzae*);
 - *Deuterophomonas tracheiphila* (syn. *Phoma tracheiphila*);
 - *Microcyclus ulei* (syn. *Dothidella ulei*);
 - *Monilia rorei* (syn. *Moniliophthora rorei*);
 - *Puccinia graminis* (syn. *Puccinia graminis* f. sp. *tritici*);
 - *Puccinia striiformis* (syn. *Puccinia glumarum*);
 - *Magnaporthe grisea* (*Pyricularia grisea*/*Pyricularia oryzae*).
- c. Viruses, whether natural, synthetic, enhanced or modified, either in the form of isolated live cultures or as material, including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
- Banana bunchy top virus;
 - Potato Andean latent tymovirus;
 - Potato spindle tuber viroid.

ANNEXURE B**I. EQUIPMENT CAPABLE OF USE IN HANDLING BIOLOGICAL MATERIALS, AS FOLLOWS:**

- a. Complete biological containment facilities at **[P3, P4]** Biosafety Level 3 or 4 containment level.

Technical Note:

[P3 or P4] (BL3, BL4, L3, L4)] Biosafety Level 3 or 4 containment levels are as specified in the WHO Laboratory Biosafety Manual (Geneva, **[1983]** 2004).

[b. Fermenters capable of cultivation of pathogenic micro-organisms, viruses or capable of toxin production, without the propagation of aerosols, and having a total capacity of 100 litres or more.

c. Fermenters of less than 100-litre capacity with special emphasis on aggregate orders or designs for use in combined systems.

Technical note

Fermenters include bioreactors, chemostats and continuous-flow systems.]

- d]b.** Centrifugal separators, capable of continuous separation of pathogenic micro-organisms, without the propagation of aerosols, having all the following characteristics:

- (i) flow rate exceeding 100 litres per hour;
- (ii) components of polished stainless steel or titanium;

(iii) double or multiple sealing joints within the steam containment area; and

(iv) capable of in-situ steam sterilisation in a closed state.

Technical Note:

Centrifugal separators include decanters.

[e]c. Cross-flow filtration equipment, capable of continuous separation without the propagation of aerosols, having all the following characteristics:

(i) a total filtration area equal to or greater than 1 m²; and

(ii) having any of the following characteristics:

- capable of being sterilized or disinfected in-situ;
- using disposable or single-use filtration components.

Technical Note:

In this control, 'sterilized' denotes the elimination of all viable microbes from the equipment through the use of either physical (eg steam) or chemical agents. 'Disinfected' denotes the destruction of potential microbial infectivity in the equipment through the use of chemical agents with a germicidal effect. 'Disinfection' and 'sterilization' are distinct from 'sanitization', the latter referring to cleaning procedures designed to lower the microbial content of equipment without necessarily achieving elimination of all microbial infectivity or viability.

[f]d. **[Steam]** Sterilisable freeze-drying equipment with a condenser capacity exceeding 50 kg of ice in 24 hours and less than 1 000 kg of ice in 24 hours.

[g]e. Equipment that incorporates or is contained in **[P3 or P4] Biosafety level 3 or 4** containment housing, as follows:

1. **[Independently ventilated protective full suits;] Protective full or half suits, or hoods dependent upon a tethered external air supply and operating under positive pressure;**

Technical Note:

This does not include suits designed to be worn with self-contained breathing apparatus.

2. Biological safety cabinets or isolators, which allow manual operations to be performed within, whilst providing an environment equivalent to Class III biological protection.

Technical Note:

Isolators include flexible isolators, drying boxes, anaerobic chambers, glove boxes, or laminar flow hoods.

[h.]f. Chambers designed for aerosol challenge testing with micro-organisms, viruses or toxins and having a capacity of 1 m³ or greater.

[i. Equipment for the micro-encapsulation of live micro-organisms and toxins in the range of 1-10 particle size, specifically:

- Interfacial polycondensators;
Phase separators.

j. Conventional or turbulent air-flow clean-air rooms and self-contained fan-HEPA filter units that may be used for P3 or P4 containment facilities]

No. 76

18 February 2015

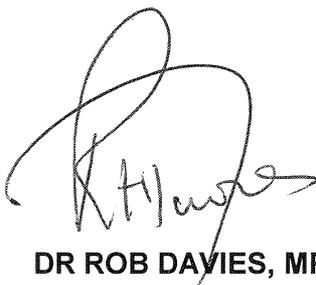
NOTICE OF AMENDMENT

1. By virtue of the powers vested in me in terms of section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), I Rob Davies, Minister of Trade and Industry, hereby –

(a) amend Notice No. 20 of 3 February 2010 as indicated in the Schedule hereto; and
(b) determine that –

- (i) words in bold type in square brackets indicate omissions from existing enactments;
- (ii) words underlined with a solid line indicate insertions in existing enactments; and
- (iii) the amendments will become operative on the date of publication of this Notice of Amendment.

2. Notice No. 20 of 3 February 2010 as amended (incorporating the amendments indicated in the Schedule hereto) is available on **the dti** website: www.thedti.gov.za/nonproliferation



DR ROB DAVIES, MP
MINISTER OF TRADE AND INDUSTRY

DATE: 26/1/15

SCHEDULE**[GOVERNMENT NOTICE]****DEPARTMENT OF TRADE AND INDUSTRY****GOVERNMENT NOTICE**

No. 20

3 February 2010

**PUBLISHED IN TERMS OF THE NON-PROLIFERATION OF WEAPONS OF MASS
DESTRUCTION ACT, 1993 (ACT NO. 87 OF 1993), AS AMENDED**

Please note: Although there are many amendments, their nature does not justify the repeal of the current Notice. Therefore, the number and year date of the amended Notice remain the same. A new number and year date have been allocated to the Notice of Amendment. Text that has been deleted is shown in bold between square brackets, [], while new insertions are underlined. Stakeholders can access a "clean amended version" (incorporating all amendments) through the website of the Council. For example, please reflect on paragraph 1(a) below, illustrating that the word **[quoted]** has been substituted with listed.

**DECLARATION OF CERTAIN NUCLEAR-RELATED DUAL-USE EQUIPMENT,
MATERIALS, [AND] SOFTWARE AND RELATED TECHNOLOGY AS
CONTROLLED GOODS, AND CONTROL MEASURES APPLICABLE TO SUCH
GOODS****Declaration**

1. I, Dr Rob Davies, Minister of Trade and Industry, under section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), and on the recommendation of the South African Council for the Non-Proliferation of Weapons of Mass Destruction, hereby declare—

- (a) all items listed in the International Atomic Energy Agency (IAEA) document INFCIRC/254/[Rev. 7] Rev. 9/Part 2, dated **[20 March**

2006] 13 November 2013, as **[quoted]** listed in the annexure to this notice, to be controlled goods;

- (b) services with regard to goods indicated in paragraph 2(c) of this notice to be controlled goods; and
- (c) component parts contemplated in Item 4 of General Note 4 of the annexure to this notice to be controlled goods.

2. I hereby—

- (a) in terms of section 13(2)(b) of the Act, further determine that the import, export, re-export and transit (including transshipment) of the controlled goods, as listed in the annexure to this notice, may only take place under a permit issued by the Council;
- (b) in terms of section 13(2)(c) of the Act, determine that the Council may require a State-to-State assurance or an end-user or end-use certificate for the export or re-export of controlled goods as listed in the annexure to this notice; and
- (c) in terms of section 13(2)(f) of the Act, determine that the manufacture of, and provision of services with regard to, controlled goods listed in Items 2.B.1, 2.B.2, 2.C.9, 2.C.17, 2.E.1, 3.B.5, 3.E.1, 4.B.1, 4.B.2, 4.B.3 and 4.E.1 of the annexure to this notice, shall take place under a permit issued by the Council.

Definitions

3. In this notice any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned and, unless the context otherwise indicates—

"component parts" means an integral part of plants, systems, assemblies or equipment without which the plant, system, assemblies or equipment will not perform their intended function or achieve the characteristics or performance level that make the plants, systems, assemblies or equipment controlled goods;

"**fabrication**" includes production, prototyping, installation, commissioning and contractual after-sales servicing;

"**manufacture**" includes research, development and fabrication;

"**services**" includes freight forwarding, storing and stockpiling (if not part of the manufacture and transfer processes), transporting, maintaining (repairing, overhauling, refurbishing), trading, consulting, disposing, and technical assistance;

"**the Act**" means the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993).

Controlled goods

4. The list of nuclear-related dual-use equipment, materials, software and related technology items contained in the annex to the IAEA document INFCIRC/254/**[Rev. 7] Rev. 9/Part 2**, dated **[20 March 2006] 13 November 2013**, **[is] as [quoted in its entirety] listed** in the annexure to this notice.

Application forms

5. Application forms for permits contemplated in paragraph 2 of this notice may be obtained from any of the following addresses:

- (a) Postal address:
The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
Private Bag X84
PRETORIA
0001; or

- (b) physical address:
The Secretariat
South African Council for the Non-Proliferation of Weapons of Mass
Destruction
77 Meintjies Street
Sunnyside
PRETORIA.

Repeal

6. Government Notice No. 430 of 10 April 2002 is hereby repealed.



DR ROB DAVIES, MP
MINISTER OF TRADE AND INDUSTRY

26/1/15

ANNEXURE

INFCIRC/254/ [Rev. 7] Rev. 9/Part 2

Date: [20 March 2006] 13 November 2013

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)

K --- kelvin

keV --- thousand electron volt(s)

kg --- kilogram(s)
kHz --- kilohertz
kN --- kilonewton(s)
kPa --- kilopascal(s)
kV --- kilovolt(s)
kW --- kilowatt(s)
m --- meter(s)
mA --- milliampere(s)
MeV --- million electron volt(s)
MHz --- megahertz
ml --- milliliter(s)
mm --- millimeter(s)
MPa --- megapascal(s)
mPa --- millipascal(s)
MW --- megawatt(s)
 μ F --- microfarad(s)
 μ m --- micrometer(s)
 μ s --- microsecond(s)
N --- newton(s)
nm --- nanometer(s)
ns --- nanosecond(s)
nH --- nanohenry(ies)
ps --- picosecond(s)
RMS --- root mean square
rpm --- revolutions per minute
s --- second(s)
T --- tesla(s)
TIR --- total indicator reading
V --- volt(s)
W --- watt(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" –

"In the public domain", as it applies herein, means "technology" or "software" that has been made available without restrictions upon its further dissemination. (Copyright restrictions do not remove "technology" or "software" from being "in the public domain".)

"Linearity" –

(Usually measured in terms of non-linearity) is the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straightline so positioned as to equalize and minimize the maximum deviations.

"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' –

See "Fibrous or filamentary materials".

"Numerical control" –

The automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress. (Ref. ISO 2382)

"Positioning accuracy" –

of "numerically controlled" machine tools is to be determined and presented in accordance with Item 1.B.2., in conjunction with the requirements below:

- (a) Test conditions (ISO 230/2 (1988), paragraph 3):
- (1) For 12 hours before and during measurements, the machine tool and accuracy measuring equipment will be kept at the same ambient temperature. During the premeasurement time, the slides of the machine will be continuously cycled identically to the way they will be cycled during the accuracy measurements;
 - (2) The machine shall be equipped with any mechanical, electronic, or software compensation to be exported with the machine;
 - (3) Accuracy of measuring equipment for the measurements shall be at least four times more accurate than the expected machine tool accuracy;
 - (4) Power supply for slide drives shall be as follows:

- (i) Line voltage variation shall not be greater than $\pm 10\%$ of nominal rated voltage;
- (ii) Frequency variation shall not be greater than ± 2 Hz of normal frequency;
- (iii) Lineouts or interrupted service are not permitted.

(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" –

See "Fibrous or filamentary materials".

"Use" –

Operation, installation (including on-site installation), maintenance (checking), repair, overhaul, and refurbishing.

"Yarn" –

See "Fibrous or filamentary materials".

ANNEX CONTENTS

1. INDUSTRIAL EQUIPMENT

1.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

- 1.A.1. High-density radiation shielding windows
- 1.A.2. Radiation-hardened TV cameras, or lenses therefor
- 1.A.3. Robots, end-effectors' and control units
- 1.A.4. Remote manipulators

1.B. TEST AND PRODUCTION EQUIPMENT

- 1.B.1. Flow-forming machines, spin-forming machines capable of flow forming functions, and mandrels
- 1.B.2. Machine tools
- 1.B.3. Dimensional inspection machines, instruments, or systems
- 1.B.4. Controlled atmosphere induction furnaces, and power supplies therefore
- 1.B.5. Isostatic presses, and related equipment
- 1.B.6. Vibration test systems, equipment, and components
- 1.B.7. Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment

1.C. MATERIALS

1.D. SOFTWARE

- 1.D.1. "Software" specially designed or modified for the "use" of equipment
- 1.D.2. "Software" specially designed or modified for the "development", "production", or "use" of equipment
- 1.D.3. "Software" for any combination of electronic devices or system enabling such device(s) to function as a "numerical control" unit for machine tools

1.E. TECHNOLOGY

- 1.E.1. "Technology" according to the Technology Controls for the "development" "production" or "use" of equipment, material or "software"

2. MATERIALS

2.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

- 2.A.1. Crucibles made of materials resistant to liquid actinide metals
- 2.A.2. Platinized catalysts
- 2.A.3. Composite structures in the forms of tubes

2.B. TEST AND PRODUCTION EQUIPMENT

- 2.B.1. Tritium facilities or plants, and equipment therefor.
- 2.B.2. Lithium isotope separation facilities or plants, and systems and equipment therefor.

2.C. MATERIALS

- 2.C.1. Aluminium
- 2.C.2. Beryllium
- 2.C.3. Bismuth
- 2.C.4. Boron
- 2.C.5. Calcium
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- 2.C.8. Hafnium
- 2.C.9. Lithium
- 2.C.10. Magnesium
- 2.C.11. Maraging steel
- 2.C.12. Radium-226
- 2.C.13. Titanium
- 2.C.14. Tungsten
- 2.C.15. Zirconium
- 2.C.16. Nickel powder and porous nickel metal
- 2.C.17. Tritium
- 2.C.18. Helium-3
- 2.C.19. **[Alpha-emitting radionuclides]** Radionuclides
- 2.C.20 Rhenium

2.D. SOFTWARE

2.E. TECHNOLOGY

- 2.E.1. "Technology" according to the Technology Controls for the "development"
"production" or "use" of equipment, material or "software"

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
- 3.A.2. Lasers, laser amplifiers and oscillators
- 3.A.3. Valves
- 3.A.4. Superconducting solenoidal electromagnets
- 3.A.5. High-power direct current power supplies
- 3.A.6. High-voltage direct current power supplies
- 3.A.7. Pressure transducers
- 3.A.8. Vacuum pumps
- 3.A.9 Bellow-sealed scroll-type compressors and vacuum pumps

3.B. TEST AND PRODUCTION EQUIPMENT

- 3.B.1. Electrolytic cells for fluorine production
- 3.B.2. Rotor fabrication or assembly equipment, rotor straightening equipment,
bellows-forming mandrels and dies
- 3.B.3. Centrifugal multiplane balancing machines
- 3.B.4. Filament winding machines and related equipment
- 3.B.5. Electromagnetic isotope separators
- 3.B.6. Mass spectrometers

3.C. MATERIALS

3.D. SOFTWARE

- 3.D.1. "Software" specially designed or modified for the "use" of equipment

3.D.2. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment not controlled in Item 3.A.1

3.D.3. "Software" specially designed to enhance or release the performance characteristics of equipment controlled in Item 3.A.1

3.E. TECHNOLOGY

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

4. HEAVY WATER PRODUCTION PLANT RELATED EQUIPMENT (Other Than Trigger List Items)

4.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

4.A.1. Specialized packings

4.A.2. Pumps

4.A.3. Turboexpanders or turboexpander-compressor sets

4.B. TEST AND PRODUCTION EQUIPMENT

4.B.1. Water-hydrogen sulfide exchange tray columns and internal contactors

4.B.2. Hydrogen-cryogenic distillation columns

4.B.3. **[Ammonia synthesis converters or synthesis units]** No longer used – since 14 June 2013

4.C. MATERIALS

4.D. SOFTWARE

4.E. TECHNOLOGY

4.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software"

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

5.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

5.A.1. Photomultiplier tubes

5.B. TEST AND PRODUCTION EQUIPMENT

5.B.1. Flash X-ray generators or pulsed electron accelerators

5.B.2. **[Multistage light gas guns or other]** High-velocity gun systems

5.B.3. **[Mechanical rotating mirror cameras]** High speed cameras and imaging devices

5.B.4. No longer used – since 14 June 2013 **[Electronic streak cameras, electronic framing cameras, tubes and devices]**

5.B.5. Specialized instrumentation for hydrodynamic experiments

5.B.6. High-speed pulse generators

5.B.7. High explosive containment vessels

5.C. MATERIALS

5.D. SOFTWARE

5.D.1. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment not controlled in Item 5.B.3

5.D.2. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment controlled in Item 5.B.3

5.E. TECHNOLOGY

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

6. COMPONENTS FOR NUCLEAR EXPLOSIVE DEVICES

6.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

- 6.A.1. Detonators and multipoint initiation systems
- 6.A.2. Firing sets and equivalent high-current pulse generators
- 6.A.3. Switching devices
- 6.A.4. Pulse discharge capacitors
- 6.A.5. Neutron generator systems
- 6.A.6. Striplines

6.B. TEST AND PRODUCTION EQUIPMENT

6.C. MATERIALS

- 6.C.1. High explosive substances or mixtures

6.D. SOFTWARE

6.E. TECHNOLOGY

- 6.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software"

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 m²;
- b. A density greater than 3 g/cm³; 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 x 10⁴ Gy (silicon) without operational degradation.

Technical Note: The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

1.A.3. 'Robots', 'end-effectors' and control units as follows:

- a. 'Robots' or 'end-effectors' having either of the following characteristics:
 1. Specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives); or
 2. Specially designed or rated as radiation hardened to withstand a total radiation dose greater than 5 x 10⁴ Gy (silicon) without operational degradation;

Technical Note: The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

- b. Control units specially designed for any of the 'robots' or 'end-effectors' specified in Item 1.A.3.a.

Note: Item 1.A.3. does not control 'robots' specially designed for non-nuclear industrial applications such as automobile paint-spraying booths.

Technical Notes: 1. 'Robots'

In Item 1.A.3. 'robot' means a manipulation mechanism, which may be of the continuous path or of the point-to-point variety, may use 'sensors', and has all of the following characteristics:

- (a) is multifunctional;
- (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 control".

Note: Item 1.B.2.b. does not control milling machines having both of the following characteristics:

1. X-axis travel greater than 2 m; and
2. Overall "positioning accuracy" on the x-axis worse (more) than 30 μm according to ISO 230/2 (1988).

c. Machine tools for grinding, having any of the following characteristics:

1. "Positioning accuracies" with all compensations available better (less) than 4 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 control."

Note: Item 1.B.2.c. does not control grinding machines as follows:

1. Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:
 - 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 simultaneously for "contouring control".

Notes: 1. Stated "positioning accuracy" levels derived under the following procedures from measurements made according to ISO 230/2 (1988) or national equivalents may be used for each machine tool model if provided to, and accepted by, national authorities instead of individual machine tests.

Stated "positioning accuracy" are to be derived as follows:

- a. Select five machines of a model to be evaluated;
 - b. Measure the linear axis accuracies according to ISO 230/2 (1988);
 - c. Determine the accuracy values (A) for each axis of each machine. The method of calculating the accuracy value is described in the ISO 230/2 (1988) standard;
 - d. Determine the average accuracy value of each axis. This average value becomes the stated "positioning accuracy" of each axis for the model (\hat{A}_x , \hat{A}_y ...);
 - e. Since Item 1.B.2. refers to each linear axis, there will be as many stated "positioning accuracy" values as there are linear axes;
 - f. If any axis of a machine tool not controlled by Items 1.B.2.a., 1.B.2.b., or 1.B.2.c. has a stated "positioning accuracy" of 6 μm or better (less) for grinding machines, and 8 μm or better (less) for milling and turning machines, both according to ISO 230/2 (1988), then the builder should be required to reaffirm the accuracy level once every eighteen months.
2. Item 1.B.2. does not control special purpose machine tools limited to the manufacture of any of the following parts:
- a. Gears
 - b. Crankshafts or camshafts
 - c. Tools or cutters
 - d. Extruder worms

Technical Notes:

1. Axis nomenclature shall be in accordance with International Standard ISO 841, "Numerical Control Machines - Axis and Motion Nomenclature".
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:

a. Computer controlled or numerically controlled coordinate measuring machines (CMM) having either of the following characteristics:

1. **[Two or more axes]** Having only two axes and having a maximum permissible error of length measurement [E0, MPE] along any axis (one dimensional), identified as any combination of E0xMPE, E0yMPE or E0zMPE, equal to or less (better) than $(1.25 + L/1000)$ μm (where L is the measured length in mm) at any point within the operating range of the machine (i.e., within the length of the axis), tested according to ISO 10360-2(2009); or
2. **[A one-dimensional length "measurement uncertainty" equal to or better (less) than $(1.25 = L/1000)$ μm tested with a probe of an "accuracy" of better (less) than 0.2 μm (L is the measured length in millimetres) (Ref: VDI/VDE/2617 parts 1 and 2);]** Three or more axes and having a three dimensional (volumetric) maximum permissible error of length measurement one (E0, MPE) equal to or better (less) than $(1.7 + L/800)$ μm (where L is the measured length in mm) at any point within the operating range of the machine (i.e., within the length of the axis), according to ISO 10360-2(2009).

Technical Note: The E0, MPE of the most accurate configuration of the CMM specified according to ISO 10360-2(2009) by the manufacturer (e.g., best of the following: probe, stylus length, motion parameters, environment) and with all compensations available shall be compared to the $1.7 + L/800$ μm threshold.

b. Linear displacement measuring instruments, as follows:

1. Non-contact type measuring systems with a "resolution" equal to or better (less) than 0.2 μm within a measuring range up to 0.2 mm;

2. Linear variable differential transformer (LVDT) systems having both of the following characteristics:

- a. ["Linearity" equal to or better (less) than 0.1% within a measuring range up to 5mm; and]
 1. "Linearity" equal to or less (better) than 0.1% measured from 0 to the full operating range, for LVDTs with an operating range up to 5 mm; or
 2. "Linearity" equal to or less (better) than 0.1% measured from 0 to 5 mm for LVDTs with an operating range greater than 5 mm; and
- b. Drift equal to or better (less) than 0.1% per day at a standard ambient test room temperature ± 1 K;

3. Measuring systems having both of the following characteristics:

- a. Contain a laser; and
- 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: 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 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.

1.B.4. Controlled atmosphere (vacuum or inert gas) induction furnaces, and power supplies therefor, as follows:

a. Furnaces having all of the following characteristics:

1. Capable of operation at temperatures above 1123 K (850 °C);
2. Induction coils 600 mm or less in diameter; and
3. Designed for power inputs of 5 kW or more;

Note: Item 1.B.4.a. does not control furnaces designed for the processing of semiconductor wafers.

b. Power supplies, with a specified output power of 5 kW or more, specially designed for 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
3. Capable of imparting forces of 50 kN or greater measured 'bare table';

b. Digital control units, combined with "software" specially designed for vibration testing, with a real-time bandwidth greater than 5 kHz and being designed for a system specified in Item 1.B.6.a.;

c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50 kN or greater measured 'bare table', which are usable for the systems specified in Item 1.B.6.a.;

d. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an effective combined force of 50 kN or greater, measured 'bare table', which are usable for the systems specified in Item 1.B.6.a.

Technical Note: In Item 1.B.6. 'bare table' means a flat table, or surface, with no fixtures or fittings.

1.B.7. Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment, as follows:

a. Arc remelt and casting furnaces having both of the following characteristics:

1. Consumable electrode capacities between 1000 and 20000 cm³; and
2. Capable of operating with melting temperatures above 1973 K (1700 °C);

b. Electron beam melting furnaces and plasma atomization and melting furnaces, having both of the following characteristics:

1. A power of 50 kW or greater; and

2. Capable of operating with melting temperatures above 1473 K (1200 °C);
- c. Computer control and monitoring systems specially configured for any of the furnaces specified in Item 1.B.7.a. or 1.B.7.b.

1.C. MATERIALS

None.

1.D. SOFTWARE

1.D.1. "Software" specially designed or modified for the "use" of equipment specified in Item 1.A.3., 1.B.1., 1.B.3., 1.B.5., 1.B.6.a., 1.B.6.b., 1.B.6.d. or 1.B.7.

Note: "Software" specially designed or modified for systems specified in Item 1.B.3.d. includes "software" for simultaneous measurements of wall thickness and contour.

1.D.2. "Software" specially designed or modified for the "development", "production", or "use" of equipment specified in Item 1.B.2.

Note: Item 1.D.2. does not control part programming "software" that generates "numerical control" command codes but does not allow direct use of equipment for machining various parts.

1.D.3. "Software" for any combination of electronic devices or system enabling such device(s) to function as a "numerical control" unit for machine tools that is capable of controlling five or more interpolating axes that can be coordinated simultaneously for "contouring control".

Notes: 1. "Software" is controlled whether exported separately or residing in a "numerical control" unit or any electronic device or system.

2. Item 1.D.3. does not control "software" specially designed or modified by the manufacturers of the control unit or machine tool to operate a machine tool that is not specified in Item 1.B.2.

1.E. TECHNOLOGY

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

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 cm³ (150 ml) and 8000 cm³ (8[L] [liters] litres); and

2. Made of or coated with any of the following materials, or combination of the following materials, having an overall [purity] impurity level of [98] 2% or [greater] less by weight:

- a. Calcium fluoride (CaF₂);
- 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 alloy (approximately 50% Nb, 30% Ti, 20% W);
- h. Yttrium oxide (yttria) (Y₂O₃); or
- i. Zirconium oxide (zirconia) (ZrO₂);

b. Crucibles having both of the following characteristics:

1. A volume of between 50 cm³ (50 ml) and 2000 cm³ (2 liters); and
2. Made of or lined with tantalum, having a purity of 99.9% or greater by weight;

c. Crucibles having all of the following characteristics:

1. A volume of between 50 cm³ (50 ml) and 2000 cm³ (2 liters);
2. Made of or lined with tantalum, having a purity of 98% or greater by weight; and
3. Coated with tantalum carbide, nitride, boride, or any combination thereof.

2.A.2. Platinized catalysts specially designed or prepared for promoting the hydrogen isotope exchange reaction between hydrogen and water for the recovery of tritium from heavy water or for the production of heavy water.

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 °C) 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 systems and equipment therefor, as follows:

N.B.: Certain lithium isotope separation equipment and components for the plasma separation process (PSP) are also directly applicable to uranium isotope separation and are controlled under INFCIRC/254 Part 1 (as amended).

- a. Facilities or plants for the separation of lithium isotopes;
- b. Equipment for the separation of lithium isotopes, based on the lithium-mercury amalgam process, 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.

c. Ion exchange systems specially designed for lithium isotope separation, and specially designed component parts therefor;

d. Chemical exchange systems (employing crown ethers, cryptands, or lariat ethers) specially designed for lithium isotope separation, and specially designed component parts therefor.

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: In Item 2.C.1. the phrase 'capable of' encompasses aluminium alloys before or after heat treatment.

2.C.2. Beryllium metal, alloys containing more than 50% beryllium by weight, beryllium compounds, manufactures thereof, and waste or scrap of any of the foregoing.

Note: Item 2.C.2. does not control the following:

- a. Metal windows for X-ray machines or for bore-hole logging devices;
- b. Oxide shapes in fabricated or semi-fabricated forms specially designed for electronic component parts or as substrates for electronic circuits;
- c. Beryl (silicate of beryllium and aluminium) in the form of emeralds or aquamarines.

2.C.3. Bismuth having both of the following characteristics:

- a. A purity of 99.99% or greater by weight; and
- b. Containing less than 10 ppm (parts per million) by weight of silver.

2.C.4. Boron enriched in the boron-10 (¹⁰B) isotope to greater than its natural isotopic abundance, as follows: elemental boron, compounds, mixtures containing boron, manufactures thereof, waste or scrap of any of the foregoing.

Note: In Item 2.C.4. mixtures containing boron include boron loaded materials.

Technical Note: The natural isotopic abundance of boron-10 is approximately 18.5 weight percent (20 atom percent).

2.C.5. Calcium having both of the following characteristics:

- a. Containing less than 1000 parts per million by weight of metallic impurities other than magnesium; and
- b. Containing less than 10 parts per million by weight of boron.

2.C.6. Chlorine trifluoride (ClF₃).

2.C.7. "Fibrous or filamentary materials", and prepregs, as follows:

a. Carbon or aramid "fibrous or filamentary materials" having either of the following characteristics:

1. A 'specific modulus' of 12.7×10^6 m or greater; or
2. A 'specific tensile strength' of 23.5×10^4 m or greater;

Note: Item 2.C.7.a. does not control aramid "fibrous or filamentary materials" having 0.25% or more by weight of an ester based **[fiber]** fibre surface modifier.

b. Glass "fibrous or filamentary materials" having both of the following characteristics:

1. A 'specific modulus' of 3.18×10^6 m or greater; and
2. A 'specific tensile strength' of 7.62×10^4 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" specified in Item 2.C.7.a. or Item 2.C.7.b.

Technical Note: The resin forms the matrix of the composite.

Technical Notes: 1. In Item 2.C.7. 'Specific modulus' is the Young's modulus in N/m² divided by the specific weight in N/m³ when measured at a temperature of 296 ± 2 K (23 ± 2 °C) and a relative humidity of $50 \pm 5\%$.

2. In Item 2.C.7. 'Specific tensile strength' is the ultimate tensile strength in N/m² divided by the specific weight in N/m³ when measured at a temperature of 296 ± 2 K (23 ± 2 °C) and a relative humidity of $50 \pm 5\%$.

2.C.8. Hafnium metal, alloys containing more than 60% hafnium by weight, hafnium compounds containing more than 60% hafnium by weight, manufactures thereof, and waste or scrap of any of the foregoing.

2.C.9. Lithium enriched in the lithium-6 (^6Li) isotope to greater than its natural isotopic abundance and products or devices containing enriched lithium, as follows: elemental lithium, alloys, compounds, mixtures containing lithium, manufactures thereof, waste or scrap of any of the foregoing.

Note: Item 2.C.9. does not control thermoluminescent dosimeters.

Technical Note: The natural isotopic abundance of lithium-6 is approximately 6.5 weight percent (7.5 atom percent).

2.C.10. Magnesium having both of the following characteristics:

- a. Containing less than 200 parts per million by weight of metallic impurities other than calcium; and
- b. Containing less than 10 parts per million by weight of boron.

2.C.11. Maraging steel 'capable of' an ultimate tensile strength of **[2050]** 1950 MPa or more at 293 K (20 °C).

Note: Item 2.C.11. does not control forms in which all linear dimensions are 75 mm or less.

Technical Note: In Item 2.C.11. the phrase 'capable of' encompasses maraging steel before or after heat treatment.

2.C.12. Radium-226 (^{226}Ra), radium-226 alloys, radium-226 compounds, mixtures containing radium-226, manufactures thereof, and products or devices containing any of the foregoing.

Note: Item 2.C.12. does not control the following:

- a. Medical applicators;
- b. A product or device containing less than 0.37 GBq of radium-226.

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

- a. 'Capable of' an ultimate tensile strength of 900 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: In Item 2.C.13. the phrase 'capable of' encompasses titanium alloys before or after heat treatment.

2.C.14. Tungsten, tungsten carbide, and alloys containing more than 90% tungsten by weight, having both of the following characteristics:

- a. In forms with a hollow cylindrical symmetry (including cylinder segments) with an inside diameter between 100 and 300 mm; and
- b. A mass greater than 20 kg.

Note: Item 2.C.14. does not control manufactures specially designed as weights or gamma-ray collimators.

2.C.15. Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight, as follows: metal, alloys containing more than 50% zirconium by weight, compounds, manufactures thereof, waste or scrap of any of the foregoing.

Note: Item 2.C.15. does not control zirconium in the form of foil having a thickness of 0.10 mm or less.

2.C.16. Nickel powder and porous nickel metal, as follows:

N.B.: For nickel powders which are especially prepared for the manufacture of gaseous diffusion barriers see INFCIRC/254/Part 1 (as amended).

- a. Nickel powder having both of the following characteristics:
 - 1. A nickel purity content of 99.0% or greater by weight; and
 - 2. A mean particle size of less than 10 µm measured by the ASTM B 330 standard;
- b. Porous nickel metal produced from materials specified in Item 2.C.16.a.

Note: Item 2.C.16. does not control the following:

- a. Filamentary nickel powders;
- b. Single porous nickel metal sheets with an area of 1000 cm² per sheet or less.

Technical Note: Item 2.C.16.b. refers to porous metal formed by compacting and sintering the material in Item 2.C.16.a. to form a metal material with fine pores interconnected throughout the structure.

2.C.17. Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen atoms exceeds 1 part in 1000, and products or devices containing any of the foregoing.

Note: Item 2.C.17. does not control a product or device containing less than 1.48×10^3 GBq of tritium.

2.C.18. Helium-3 (^3He), mixtures containing helium-3, and products or devices containing any of the foregoing.

Note: Item 2.C.18. does not control a product or device containing less than 1 g of helium-3.

2.C.19. **[Alpha-emitting radionuclides having an alpha half-life of 10 days or greater but less than 200 years, in the following forms:]** Radionuclides appropriate for making neutron sources based on alpha-n reaction:

<u>Actinium 225</u>	<u>Curium 244</u>	<u>Polonium 209</u>
<u>Actinium 227</u>	<u>Einsteinium 253</u>	<u>Polonium 210</u>
<u>Californium 253</u>	<u>Einsteinium 254</u>	<u>Radium 223</u>
<u>Curium 240</u>	<u>Gadolinium 148</u>	<u>Thorium 227</u>
<u>Curium 241</u>	<u>Plutonium 236</u>	<u>Thorium 228</u>
<u>Curium 242</u>	<u>Plutonium 238</u>	<u>Uranium 230</u>
<u>Curium 243</u>	<u>Polonium 208</u>	<u>Uranium 232</u>

In the following forms:

- a. Elemental;
- b. Compounds having a total **[alpha]** activity of 37 GBq per kg or greater;
- c. Mixtures having a total **[alpha]** activity of 37 GBq per kg or greater;
- d. Products or devices containing any of the foregoing.

Note: Item 2.C.19. does not control a product or device containing less than 3.7 GBq of activity.

2.C.20. Rhenium, and alloys containing 90% by weight or more rhenium; and alloys of rhenium and tungsten containing 90% by weight or more of any combination of rhenium and tungsten, having both of the following characteristics:

- a. In forms with a hollow cylindrical symmetry (including cylinder segments) with an inside diameter between 100 and 300 mm; and
- b. A mass greater than 20kg.

2.D. SOFTWARE

None

2.E. TECHNOLOGY

2.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software" specified in 2.A. through 2.D.

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, usable as a variable frequency or fixed frequency motor drive, having all of the following characteristics:

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

N.B.2: "Software" specially designed to enhance or release the performance of frequency changers or generators to meet the characteristics below is controlled in 3.D.2 and 3.D.3.

- a. Multiphase output [**capable of**] providing a power of 40 [**W**] VA or greater;
- b. [**Capable of operating in the frequency range between 600 and 200 Hz;**] Operating at a frequency of 600 Hz or more; and
- [**c. Total harmonic distortion better (less) than 10%; and**]

[d] c. Frequency control better (less) than [0.1%] 0.2%.

Notes: 1. Item 3.A.1. only controls frequency changers intended for specific industrial machinery and/or consumer goods (machine tools, vehicles, etc.) if the frequency changers can meet the characteristics above when removed, and subject to General Note 3.

2. For the purpose of export control, the Government will determine whether or not a particular frequency changer meets the characteristics above, taking into account hardware and software constraints.

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

2. The characteristics specified in item 3.A.1. may be met by certain equipment marketed such as: Generators, Electronic Test Equipment, AC Power Supplies, Variable Speed Motor Drives, Variable Speed Drives (VSDs), Variable Frequency Drives (VFDs), Adjustable Frequency Drives (AFDs), or Adjustable Speed Drives (ASDs).

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

a. Copper vapor lasers having both of the following characteristics:

1. Operating at wavelengths between 500 and 600 nm; and
2. An average output power equal to or greater than **[40]** 30 W;

b. Argon ion lasers having both of the following characteristics:

1. Operating at wavelengths between 400 and 515 nm; and
2. An average output power greater than 40 W;

c. Neodymium-doped (other than glass) lasers with an output wavelength between 1000 and 1100 nm having either of the following:

1. Pulse-excited and Q-switched with a pulse duration equal to or greater than 1 ns, and having either of the following:
 - a. A single-transverse mode output with an average output power greater than 40 W; or
 - b. A multiple-transverse mode output with an average output power greater than 50 W;

or

2. Incorporating frequency doubling to give an output wavelength between 500 and 550 nm with an average output power of greater than 40 W;

d. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:

1. Operating at wavelengths between 300 and 800 nm;
2. An average output power greater than 1 W;
3. A repetition rate greater than 1 kHz; and
4. Pulse width less than 100 ns;

e. Tunable pulsed dye laser amplifiers and oscillators having all of the following characteristics:

1. Operating at wavelengths between 300 and 800 nm;
2. An average output power greater than 30 W;
3. A repetition rate greater than 1 kHz; and
4. Pulse width less than 100 ns;

Note: Item 3.A.2.e. does not control single mode oscillators.

f. Alexandrite lasers having all of the following characteristics:

1. Operating at wavelengths between 720 and 800 nm;
2. A bandwidth of 0.005 nm or less;
3. A repetition rate greater than 125 Hz; and
4. An average output power greater than 30 W;

g. Pulsed carbon dioxide lasers having all of the following characteristics:

1. Operating at wavelengths between 9000 and 11000 nm;
2. A repetition rate greater than 250 Hz;
3. An average output power greater than 500 W; and
4. Pulse width of less than 200 ns;

Note: Item 3.A.2.g. does not control the higher power (typically 1 to 5 kW) industrial CO₂ lasers used in applications such as cutting and welding, as these latter lasers are either continuous wave or are pulsed with a pulse width greater than 200 ns.

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.

j. Pulsed carbon monoxide lasers having all of the following characteristics:

1. Operating at wavelengths between 5000 and 6000 nm;
2. A repetition rate greater than 250 Hz;
3. An average output power greater than 200 W; and
4. Pulse width of less than 200 ns.

Note: Item 3.A.2.j. does not control the higher power (typically 1 to 5 kW) industrial CO lasers used in applications such as cutting and welding, as these latter lasers are either continuous wave or are pulsed with a pulse width greater than 200 ns.

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, over a time period of 8 hours, 100 V or greater with current output of 500 A or greater; and
- b. Current or voltage stability better than 0.1% over a time period of 8 hours.

3.A.6. High-voltage direct current power supplies having both of the following characteristics:

- a. Capable of continuously producing, over a time period of 8 hours, 20 kV or greater with current output of 1 A or greater; and
- b. Current or voltage stability better than 0.1% over a time period of 8 hours.

3.A.7. **[Pressure]** All types of pressure transducers capable of measuring absolute pressures **[at any point in the range 0 to 13 kPa]** and having **[both]** all of the following characteristics:

a. Pressure sensing elements made of or protected by aluminium, aluminium alloy, aluminium oxide (alumina or sapphire), nickel, **[or]** nickel alloy with more than 60% nickel by weight **[, and]**, or fully fluorinated hydrocarbon polymers;

b. Seals, if any, essential for sealing the pressure sensing element, and in direct contact with the process medium, made of or protected by aluminium, aluminium alloy, aluminium oxide (alumina or sapphire), nickel, nickel alloy with more than 60% nickel by weight, or fully fluorinated hydrocarbon polymers; and

[b.] c. Having either of the following characteristics:

1. A full scale of less than 13 kPa and an "accuracy" of better than $\pm 1\%$ of full scale; or
2. A full scale of 13 kPa or greater and an "accuracy" of better than ± 130 Pa when measuring at 13 kPa.

Technical Notes: 1. In Item 3.A.7. pressure transducers are devices that convert pressure measurements into a signal.

2. In Item 3.A.7. "accuracy" includes non-linearity, hysteresis and repeatability at ambient temperature.

3.A.8. Vacuum pumps having all of the following characteristics:

- a. Input throat size equal to or greater than 380 mm;
- b. Pumping speed equal to or greater than 15 m³/s; and
- c. Capable of producing an ultimate vacuum better than 13.3 mPa.

Technical Notes: 1. The pumping speed is determined at the measurement point with nitrogen gas or air.

2. The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off.

3.A.9 Bellows-sealed scroll-type compressors and bellows-sealed scroll-type vacuum pumps having all of the following characteristics:

- a. Capable of an inlet volume flow rate of 50 m³/h or greater;
- b. Capable of a pressure ratio of 2:1 or greater; and
- c. Having all surfaces that come in contact with the process gas made from any of the following materials:

1. Aluminium or aluminium alloy;
2. Aluminium oxide;
3. Stainless steel;
4. Nickel or nickel alloy;
5. Phosphor bronze; or
6. Fluoropolymers.

Technical Notes: 1. In a scroll compressor or vacuum pump, crescent-shaped pockets of gas are trapped between one or more pairs of intermeshed spiral vanes, or scrolls, one of which moves while the other remains stationary. The moving scroll orbits the stationary scroll; it does not rotate. As the moving scroll orbits the stationary scroll, the gas pockets diminish in size (i.e., they are compressed) as they move toward the outlet port of the machine.

2. In a bellows-sealed scroll compressor or vacuum pump, the process gas is totally isolated from the lubricated parts of the pump and from the external atmosphere by a metal bellows. One end of the bellows is attached to the moving scroll and the other end is attached to the stationary housing of the pump.

3. Fluoropolymers include, but are not limited to, the following materials:

- a. Polytetrafluoroethylene (PTFE),
- b. Fluorinated Ethylene Propylene (FEP),

c. Perfluoroalkoxy (PFA).

d. Polychlorotrifluoroethylene (PCTFE); and

e. Vinylidene fluoride-hexafluoropropylene copolymer.

3.B. TEST AND PRODUCTION EQUIPMENT

3.B.1. Electrolytic cells for fluorine production with an output capacity greater than 250 g of fluorine per hour.

3.B.2. Rotor fabrication or assembly equipment, rotor straightening equipment, bellows-forming mandrels and dies, as follows:

a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles, and end caps;

Note: Item 3.B.2.a. includes precision mandrels, clamps, and shrink fit machines.

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 probes linked to a computer that subsequently controls the action of, for example, pneumatic rams used for aligning the rotor tube sections.

c. Bellows-forming mandrels and dies for producing single-convolution bellows.

Technical Note: The bellows referred to in Item 3.B.2.c. have all of the following characteristics:

- 1. Inside diameter between 75 and 400 mm;*
- 2. Length equal to or greater than 12.7 mm;*
- 3. Single convolution depth greater than 2 mm; and*
- 4. Made of high-strength aluminium alloys, maraging steel, or high strength "fibrous or filamentary materials".*

3.B.3. Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows:

a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics:

1. Swing or journal diameter greater than 75 mm;
2. Mass capability of from 0.9 to 23 kg; and

3. Capable of balancing speed of revolution greater than 5000 rpm;
- b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:
 1. Journal diameter greater than 75 mm;
 2. Mass capability of from 0.9 to 23 kg;
 3. Capable of balancing to a residual imbalance equal to or less than 0.010 kg x mm/kg per plane; and
 4. Belt drive type.

3.B.4. Filament winding machines and related equipment, as follows:

- a. Filament winding machines having all of the following characteristics:
 1. Having motions for positioning, wrapping, and winding fibers coordinated and programmed in two or more axes;
 2. Specially designed to fabricate composite structures or laminates from "fibrous or filamentary materials"; and
 3. Capable of winding cylindrical **[rotors of diameter]** tubes with an internal diameter between 75 and **[400]** 650 mm and lengths of **[600]** 300 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 UF₆] having both of the following features:**

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

[1. A source chamber constructed from, lined with]

1. A molecular beam inlet system that injects a collimated beam of analyte molecules into a region of the ion source where the molecules are ionized by an electron beam; and

[plated with stainless steel or molybdenum, and equipped with a]

2. One or more cold [trap capable of cooling] traps that can be cooled to a temperature of 193 K (-80 °C) or less [;or] [A source chamber constructed from, lined with or plated with materials resistant] in order to [UF₆] trap analyte molecules that are not ionized by the electron beam;

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

Technical Notes: 1. Item 3.B.6.d describes mass spectrometers that are typically used for isotopic analysis of UF₆ gas samples.

2. Electron bombardment mass spectrometers in Item 3.B.6.d are also known as electron impact mass spectrometers or electron ionization mass spectrometers.

3. In Item 3.B.6.d.2, a 'cold trap' is a device that traps gas molecules by condensing or freezing them on cold surfaces. For the purposes of this entry, a closed-loop gaseous helium cryogenic vacuum pump is not a cold trap.

3.C. MATERIALS

None.

3.D. SOFTWARE

3.D.1. "Software" specially designed for the "use" of equipment specified in [item] items 3.A.1., 3.B.3. or 3.B.4.

3.D.2. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment not controlled in Item 3.A.1. so that it meets or exceeds the characteristics specified in Item 3.A.1.

3.D.3 "Software" specially designed to enhance or release the performance characteristics of equipment controlled in Item 3.A.1.

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.

4. HEAVY WATER PRODUCTION PLANT RELATED EQUIPMENT (Other than trigger list items)

4.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

4.A.1. Specialized packings which may be used in separating heavy water from ordinary water, having both of the following characteristics:

- a. Made of phosphor bronze mesh chemically treated to improve wettability; and
- b. Designed to be used in vacuum distillation towers.

4.A.2. Pumps capable of circulating solutions of concentrated or dilute potassium amide catalyst in liquid ammonia (KNH_2/NH_3), having all of the following characteristics:

- a. Airtight (i.e., hermetically sealed);
- b. A capacity greater than $8.5 \text{ m}^3/\text{h}$; and
- c. Either of the following characteristics:
 1. For concentrated potassium amide solutions (1% or greater), an operating pressure of 1.5 to 60 MPa; or
 2. For dilute potassium amide solutions (less than 1%), an operating pressure of 20 to 60 MPa.

4.A.3. Turboexpanders or turboexpander-compressor sets having both of the following characteristics:

- a. Designed for operation with an outlet temperature of 35 K (- 238 °C) or less; and
- b. Designed for a throughput of hydrogen gas of 1000 kg/h or greater.

4.B. TEST AND PRODUCTION EQUIPMENT

4.B.1. Water-hydrogen sulfide exchange tray columns and internal contactors, as follows:

N.B.: For columns which are especially designed or prepared for the production of heavy water, see INFCIRC/254/Part 1 (as amended).

a. Water-hydrogen sulfide exchange tray columns, having all of the following characteristics:

1. Can operate at pressures of 2 MPa or greater;
2. Constructed of carbon steel having an austenitic ASTM (or equivalent standard) grain size number of 5 or greater; and
3. With a diameter of 1.8 m or greater;

b. Internal contactors for the water-hydrogen sulfide exchange tray columns specified in Item 4.B.1.a.

Technical Note: Internal contactors of the columns are segmented trays which have an effective assembled diameter of 1.8 m or greater; are designed to facilitate countercurrent contacting and are constructed of stainless steels with a carbon

content of 0.03% or less. These may be sieve trays, valve trays, bubble cap trays or turbogrid trays.

4.B.2. Hydrogen-cryogenic distillation columns having all of the following characteristics:

- a. Designed for operation at internal temperatures of 35 K (-238 °C) or less;
- b. Designed for operation at internal pressures of 0.5 to 5 MPa;
- c. Constructed of either:
 1. Stainless steel of the 300 series with low sulfur content and with an austenitic ASTM (or equivalent standard) grain size number of 5 or greater; or
 2. Equivalent materials which are both cryogenic and H₂-compatible; and
- d. With internal diameters of **[1m]** 30 cm or greater and 'effective lengths' of **[5]** 4m or greater.

Technical Note: The term 'effective length' means the active height of packing material in a packed-type column, or the active height of internal contactor plates in a plate-type column.

[4.B.3 Ammonia synthesis converters or synthesis units, in which the synthesis gas (nitrogen and hydrogen) is withdrawn from an ammonia/hydrogen high-pressure exchange column and the synthesized ammonia is returned to said column.] [No longer used – since 14 June 2013]

4.C. MATERIALS

None.

4.D. SOFTWARE

None.

4.E. TECHNOLOGY

4.E.1. "Technology" according to the Technology Controls for the "development", "production" or "use" of equipment, material or "software" specified in 4.A. through 4.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 cm²; 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 μ s, then Q is the total accelerated charge in Coulombs. If the accelerator beam pulse duration is greater than 1 μ s, then Q is the maximum accelerated charge in 1 μ s. Q equals the integral of i with respect to t, over the lesser of 1 μ s 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 μ s 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 (propellant, gas, coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to **[2] 1.5 km/s** or greater.

Note: This item does not control guns specially designed for high velocity weapon systems.

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

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

b. Streak cameras with writing speeds greater than 0.5 mm/ μ s.]

High-speed cameras and imaging devices and components therefor, as follows:

N.B.: "Software" specially designed to enhance or release the performance of cameras or imaging devices to meet the characteristics below is controlled in 5.D.1 and 5.D.2.

a. Streak cameras, and specially designed components therefor, as follows:

1. Streak cameras with writing speeds greater than 0.5 mm/ $[\mu$ s.] μ s:

[Note: In item 5.B.3 components of such cameras includes their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors and bearings.]

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

3. Streak tubes for cameras specified in 5.B.3.a.2.;

4. Plug-ins specially designed for use with streak cameras which have modular structures and that enable the performance specifications in 5.B.3.a.1 or 5.B.3.a.2.;

5. Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings specially designed for cameras specified in 5.B.3.a.1.

b. Framing cameras and specially designed components therefor as follows:

1. Framing cameras with recording rates greater than 225,000 frames per second;

2. Framing cameras capable of 50 ns or less frame exposure time;

3. Framing tubes and solid-state imaging devices having a fast image gating (shutter) time of 50ns or less specially designed for cameras specified in 5.B.3.b.1 or 5.B.3.b.2.;

4. Plug-ins specially designed for use with framing cameras which have modular structures and that enable the performance specifications in 5.B.3.b.1 or 5.B.3.b.2;

5. Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings specially designed for cameras specified in 5.B.3.b.1 or 5.B.3.b.2.

c. Solid state or electron tube cameras and specially designed components therefor as follows:

1. Solid-state cameras or electron tube cameras with a fast image gating (shutter) time of 50 ns or less;

2. Solid-state imaging devices and image intensifier tubes having a fast image gating (shutter) time of 50 ns or less specially designed for cameras specified in 5.B.3.c.1.;

3. Electro-optical shuttering devices (Kerr or Pockels cells) with a fast image gating (shutter) time of 50 ns or less;

4. Plug-ins specially designed for use with cameras which have modular structures and that enable the performance specifications in 5.B.3.c.1.

Technical Note: High speed single frame cameras can be used alone to produce a single image of a dynamic event, or several such cameras can be combined in a sequentially-triggered system to produce multiple images of an event.

5.B.4. *No longer used – since 14 June 2013* [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 μ s;
- b. [Manganin]Shock pressure gauges [for] capable of measuring pressures greater than 10 GPa, including gauges made with manganin, ytterbium, and polyvinylidene bifluoride (PVBF, PVF₂):
- 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)]** Interferometer Systems for Any Reflector), DLIs (Doppler Laser Interferometers) and PDV (Photonic Doppler Velocimeters) also known as Het-V (Heterodyne Velocimeters).

5.B.6. High-speed pulse generators, and pulse heads therefor, 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]Notes:

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

2. Pulse heads are impulse forming networks designed to accept a voltage step function and shape it into a variety of pulse forms that can include rectangular, triangular, step, impulse, exponential, or monocycle types. Pulse heads can be an integral part of the pulse generator, they can be a plug-in module to the device or they can be an externally connected device.

5.B.7. High explosive containment vessels, chambers, containers and other similar containment devices designed for the testing of high explosives or explosive devices and having both of the following characteristics:

- a. Designed to fully contain an explosion equivalent to 2 kg of TNT or greater; and

b. Having design elements or features enabling real time or delayed transfer of diagnostic or measurement information.

5.C. MATERIALS

None.

5.D. SOFTWARE

[None]

5.D.1. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment not controlled in Item 5.B.3. so that it meets or exceeds the characteristics specified in Item 5.B.3.

5.D.2. "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment controlled in Item 5.B.3.

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:

1. Exploding bridge (EB);
2. Exploding bridge wire (EBW);
3. Slapper;
4. Exploding foil initiators (EFI);

b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface over an area greater than 5000 mm² from a single firing signal with an initiation timing spread over the surface of less than 2.5 μ s.

Note: Item 6.A.1. does not control detonators using only primary explosives, such as lead azide.

Technical Note: In Item 6.A.1. the detonators of concern all utilize a small electrical conductor (bridge, bridge wire, or foil) that explosively vaporizes when a fast, high-current electrical pulse is passed through it. In non-slapper types, the exploding conductor starts a chemical detonation in a contacting high explosive material such as PETN (pentaerythritoltetranitrate). In slapper detonators, the explosive vaporization of the electrical conductor drives a flyer or slapper across a gap, and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by magnetic force. The term exploding foil detonator may refer to either an EB or a slapper-type detonator. Also, the word initiator is sometimes used in place of the word detonator.

6.A.2. Firing sets and equivalent high-current pulse generators, as follows:

a. **[Explosive]** Detonator firing sets (initiation systems, firesets), including electronically-charged, explosively-driven and optically-driven firing sets designed to drive multiple controlled detonators specified by Item 6.A.1. above;

b. Modular electrical pulse generators (pulsers) having all of the following characteristics:

1. Designed for portable, mobile, or ruggedized-use;

[2. Enclosed in a dust-tight enclosure;]

2. Capable of delivering their energy in less than 15 μ s into loads of less than 40 ohms;

[4] 3. Having an output greater than 100 A;

[5. Having a 'rise time' of less than 10 μ s into loads of less than 40 ohms;]

[3] 4. No dimension greater than **[25.4]** 30 cm;

[7] 5. Weight less than **[25]** 30 kg; and

[8] 6. Specified to operate over an extended temperature range of 223 to 373 K (-50 °C to 100 °C) or specified as suitable for aerospace applications.

c. Micro-firing units having all of the following characteristics:

1. No dimension greater than 35 mm;

2. Voltage rating of equal to or greater than 1 kV; and

3. Capacitance of equal to or greater than 100 nF.

Note: **[Item 6.A.2.b.]** Optically driven firing sets include both those employing laser initiation and laser charging. Explosively-driven firing sets include both explosive ferroelectric and explosive ferromagnetic firing set types. Item 6.A.2.b. includes xenon flash lamp drivers.

[Technical Note: In Item 6.A.2.b.5. 'rise time' is defined as the time interval from 10% to 90% current amplitude when driving a resistive load.]

6.A.3. Switching devices as follows:

a. Cold-cathode tubes, whether gas filled or not, operating similarly to a spark gap, having all of the following characteristics:

1. Containing three or more electrodes;

2. Anode peak voltage rating of 2.5 kV or more;

3. Anode peak current rating of 100 A or more; and

4. Anode delay time of 10 μ s or less;

Note: Item 6.A.3.a. includes gas krytron tubes and vacuum sprytron tubes.

b. Triggered spark-gaps having both of the following characteristics:

1. Anode delay time of 15 μ s or less; and

2. Rated for a peak current of 500 A or more;

c. Modules or assemblies with a fast switching function having all of the following characteristics:

1. Anode peak voltage rating greater than 2 kV;
2. Anode peak current rating of 500 A or more; and
3. Turn-on time of 1 μ s or less.

6.A.4. Pulse discharge capacitors having either of the following sets of characteristics:

- a.
 1. Voltage rating greater than 1.4 kV;
 2. Energy storage greater than 10 J;
 3. Capacitance greater than 0.5 μ F; and
 4. Series inductance less than 50 nH; or
- b.
 1. Voltage rating greater than 750 V;
 2. Capacitance greater than 0.25 μ F; 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.
 1. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction;

or

 2. Utilizing electrostatic acceleration to induce a deuterium-deuterium nuclear reaction and capable of an output of 3×10^9 neutrons/s or greater.

6.A.6. Striplines to provide low inductance path to detonators with the following characteristics:

- a. Voltage rating greater than 2 kV; and
- b. Inductance of less than 20 nH.

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] Aminodinitrobenzo-furoxan or 7-amino-4,6 nitrobenzofurazane-1-oxide (ADNBF) (CAS 97096-78-1);
- e. **[Any explosive with a crystal density greater than 1.8 g/cm³ and having a detonation velocity greater than 8000 m/s.]** 1,1-diamino-2,2-dinitroethylene (DADE or FOX7) (CAS 145250-81-3);
- f. 2,4-dinitroimidazole (DNI) (CAS 5213-49-0);
- g. Diaminoazoxyfurazan (DAAOF or DAAF) (CAS 78644-89-0);
- h. Diaminotrinitrobenzene (DATB) (CAS 1630-08-6);
- i. Dinitroglycoluril (DNGU or DINGU) (CAS 55510-04-8);
- j. 2,6-Bis (picrylamino)-3,5-dinitropyridine (PYX) (CAS 38082-89-2);
- k. 3,3'-diamino-2,2',4,4',6,6'-hexanitrobiphenyl or dipicramide (DIPAM) (CAS 17215-44-0);
- l. Diaminoazofurazan (DAAzF) (CAS 78644-90-3);
- m. 1,4,5,8-tetranitro-pyridazino[4,5-d] pyridazine (TNP) (CAS 229176-04-9);
- n. Hexanitrostilbene (HNS) (CAS 20062-22-0); or
- o. Any explosive with a crystal density greater than 1.8 g/cm³ 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.

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No. 77

18 February 2015

NOTICE OF AMENDMENT

1. By virtue of the powers vested in me in terms of section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), I Rob Davies, Minister of Trade and Industry, hereby –

(a) amend Notice No. 22 of 3 February 2010 as indicated in the Schedule hereto; and
(b) determine that –

- (i) words in bold type in square brackets indicate omissions from existing enactments;
- (ii) words underlined with a solid line indicate insertions in existing enactments; and
- (iii) the amendments will become operative on the date of publication of this Notice of Amendment.

2. Notice No. 22 of 3 February 2010 as amended (incorporating the amendments indicated in the Schedule hereto) is available on **the dti** website: www.thedti.gov.za/nonproliferation



DR ROB DAVIES, MP
MINISTER OF TRADE AND INDUSTRY

DATE: 26/1/15

SCHEDULE**[GOVERNMENT NOTICE]****DEPARTMENT OF TRADE AND INDUSTRY****GOVERNMENT NOTICE**

No. 22

3 February 2010

**PUBLISHED IN TERMS OF THE NON-PROLIFERATION OF WEAPONS OF MASS
DESTRUCTION ACT, 1993 (ACT NO. 87 OF 1993), AS AMENDED**

Please note: Although there are many amendments, their nature does not justify the repeal of the current Notice. Therefore, the number and year date of the amended Notice remain the same. A new number and year date have been allocated to the Notice of Amendment. Text that has been deleted is shown in bold between square brackets, [], while new insertions are underlined.

Stakeholders can access a "clean amended version" (incorporating all amendments) through the website of the Council. For example, please reflect on paragraph 1(a) below, illustrating that the word [quoted] has been substituted with listed.

**DECLARATION OF CERTAIN MISSILE TECHNOLOGY AND RELATED ITEMS AS
CONTROLLED GOODS AND CONTROL MEASURES APPLICABLE TO SUCH
GOODS****Declaration**

1. I, Dr Rob Davies, Minister of Trade and Industry, under section 13(1) of the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993), and on the recommendation of the South African Council for the Non-Proliferation of Weapons of Mass Destruction, hereby declare—

- (a) the goods listed in the Missile Technology Control Regime (MTCR) Equipment and Technology Annex, Dated 17 October 2013, as [quoted] listed in the annexure to this notice, to be controlled goods;
- (b) services with regard to goods indicated in paragraph 2(d) of this notice to

be controlled goods; and

(c) component parts to be controlled goods.

2. I hereby—

(a) in terms of section 13(2)(a) of the Act, further prohibit the transfer of Category 1 production facilities listed in the annexure to this notice;

(b) in terms of section 13(2)(b) of the Act, determine that the import, export, re-export or transit (including transshipment) of the controlled goods listed in the annexure to this notice, shall take place under a permit issued by the Council;

(c) in terms of section 13(2)(c) of the Act, determine that the Council may require a State-to-State assurance or an end-user or end-use certificate for the export or re-export of the controlled goods listed in the annexure to this notice; and

(d) in terms of section 13(2)(f) of the Act, determine that the manufacture of, and provision of services with respect to, the controlled goods listed in paragraphs 1, 2, 19 and 20 of the annexure to this notice, shall take place under a permit issued by the Council.

Definitions

3. In this notice any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned and, unless the context otherwise indicates—

"component parts" means an integral part of plants, systems, assemblies or equipment without which the plant, system, assemblies or equipment will not perform their intended function or achieve the characteristics or performance level that make the plants, systems, assemblies or equipment controlled goods;

"fabrication" includes production, prototyping, installation, commissioning, and contractual after-sales servicing;

"manufacture" includes research, development and fabrication;

"production facilities" means production equipment and specially designed software that are or can be utilised in facilities for development or for one or more phases of production;

"services" includes freight forwarding, storing and stockpiling (if not part of the manufacture and transfer processes), transporting, maintaining (repairing, overhauling, refurbishing), trading, consulting, disposing, and technical assistance;

"the Act" means the Non-Proliferation of Weapons of Mass Destruction Act, 1993 (Act No. 87 of 1993); as amended; and

"transfer" means the change of ownership or custodianship, or a change in the location, of goods, services and technology related to controlled goods, whether or not such goods, services and technology cross an international border.

Controlled goods

4. The list of missile-related controlled goods and related technology is contained in the Missile Technology Control Regime (MTCR) Equipment, Software and Technology Annex, updated 17 October 2013 and [quoted] listed in the annexure to this notice.

Application forms

5. Application forms for permits contemplated in paragraph 2 of this notice may be obtained from any of the following addresses:

(a) Postal address:

The Secretariat

South African Council for the Non-Proliferation of Weapons of Mass
Destruction

Private Bag X84

PRETORIA

0001; or

(b) physical address:

The Secretariat

South African Council for the Non-Proliferation of Weapons of Mass
Destruction

77 Meintjies Street

Sunnyside

PRETORIA.

Repeal

6. Government Notice No. 331 of 11 April 2007 is hereby repealed.



DR ROB DAVIES, MP

MINISTER OF TRADE AND INDUSTRY

26/1/15

ANNEXURE**[QUOTE]****INTRODUCTION**

- (a) This Annex consists of two categories of items, which term includes equipment, materials, "software" or "technology". Category I items, all of which are in Annex Items 1 and 2, are those items of greatest sensitivity. If a Category I item is included in a system, that system will also be considered as Category I, except when the incorporated item cannot be separated, removed or duplicated. Category II items are those items in the Annex not designated Category I.
- (b) In reviewing the proposed applications for transfers of complete rocket and unmanned aerial vehicle systems described in Items 1 and 19, and of equipment, materials, "software" or "technology" which is listed in the Technical Annex, for potential use in such systems, the Government will take account of the ability to trade off "range" and "payload".
- (c) **General Technology Note:**

The transfer of "technology" directly associated with any goods controlled in the Annex is controlled according to the provisions in each Item 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, or repair of the item.

Note:

Controls do not apply to "technology" "in the public domain" or to "basic scientific research".

- (d) **General Software Note:**

The Annex does not control "software" which is either:

1. Generally available to the public by being:

- a. Sold from stock at retail selling points without restriction, by means of:
 1. Over-the-counter transactions;
 2. Mail order transactions; **[or]**
 3. Electronic transactions; or
 4. Telephone call transactions; and
 - b. Designed for installation by the user without further substantial support by the supplier; or
2. "In the public domain".

Note:

The General Software Note only applies to general purpose, mass market "software".

(e) **Chemical Abstracts Service (CAS) Numbers:**

In some instances chemicals are listed by name and CAS number. Chemicals of the same structural formula (including hydrates) are controlled regardless of name or CAS number. CAS numbers are shown to assist in identifying whether a particular chemical or mixture is controlled, irrespective of nomenclature. CAS numbers cannot be used as unique identifiers because some forms of the listed chemical have different CAS numbers, and mixtures containing a listed chemical may also have different CAS numbers.

2. **DEFINITIONS**

For the purpose of this Annex, the following definitions apply:

"Accuracy"

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

"Basic scientific research"

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

"Development"

Is related to all phases prior to "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

"In the public domain"

This means "software" or "technology" which has been made available without restrictions upon its further dissemination. (Copyright restrictions do not remove "software" or "technology" from being "in the public domain".)

"Microcircuit"

A device in which a number of passive and/or active elements are considered as indivisibly associated on or within a continuous structure to perform the function of a circuit.

"Microprogrammes"

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

"Payload"

The total mass that can be carried or delivered by the specified rocket system or unmanned aerial vehicle (UAV) system that is not used to maintain flight.

Note:

The particular equipment, subsystems, or components to be included in the "payload" depends on the type and configuration of the vehicle under consideration.

Technical Notes:

1. *Ballistic Missiles*

a. *"Payload" for systems with separating re-entry vehicles (RVs) includes:*

1. *The RVs, including:*
 - a. *Dedicated guidance, navigation, and control equipment;*
 - b. *Dedicated countermeasures equipment;*
2. *Munitions of any type (e.g. explosive or non-explosive);*
3. *Supporting structures and deployment mechanisms for the munitions (e.g. hardware used to attach to, or separate the RV from, the bus/post-boost vehicle) that can be removed without violating the structural integrity of the vehicle;*
4. *Mechanisms and devices for safing, arming, fuzing or firing;*
5. *Any other countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that separate from the RV bus/post-boost vehicle;*
6. *The bus/post-boost vehicle or attitude control/velocity trim module not including systems/subsystems essential to the operation of the other stages.*

b. *"Payload" for systems with non-separating re-entry vehicles includes:*

1. *Munitions of any type (e.g. explosive or non-explosive);*
2. *Supporting structures and deployment mechanisms for the munitions that can be removed without violating the structural integrity of the vehicle;*
3. *Mechanisms and devices for safing, arming, fuzing or firing;*

4. *Any countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle.*

2. *Space Launch Vehicles*

"Payload" includes:

- a. *Spacecraft (single or multiple), including satellites;*
- b. *Spacecraft-to-launch vehicle adapters including, if applicable, apogee/perigee kick motors or similar manoeuvring systems and separation systems.*

3. *Sounding Rockets*

"Payload" includes:

- a. *Equipment required for a mission, such as data gathering, recording or transmitting devices for mission-specific data;*
- b. *Recovery equipment (e.g. parachutes) that can be removed without violating the structural integrity of the vehicle.*

4. *Cruise Missiles*

"Payload" includes:

- a. *Munitions of any type (e.g. explosive or non-explosive);*
- b. *Supporting structures and deployment mechanisms for the munitions that can be removed without violating the structural integrity of the vehicle;*
- c. *Mechanisms and devices for safing, arming, fuzing or firing;*
- d. *Countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle;*
- e. *Signature alteration equipment that can be removed without violating the structural integrity of the vehicle.*

5. *Other UAVs*

"Payload" includes:

- a. *Munitions of any type (e.g. explosive or non-explosive);*
- b. *Mechanisms and devices for safing, arming, fuzing or firing;*

- c. Countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle;*
- d. Signature alteration equipment that can be removed without violating the structural integrity of the vehicle;*
- e. Equipment required for a mission such as data gathering, recording or transmitting devices for mission-specific data and supporting structures that can be removed without violating the structural integrity of the vehicle;*
- f. Recovery equipment (e.g. parachutes) that can be removed without violating the structural integrity of the vehicle.*
- g. Munitions supporting structures and deployment mechanisms that can be removed without violating the structural integrity of the vehicle.*

"Production"

Means all production phases such as:

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

"Production equipment"

Means tooling, templates, jigs, mandrels, moulds, dies, fixtures, alignment mechanisms, test equipment, other machinery and components therefor, limited to those specially designed or modified for "development" or for one or more phases of "production".

"Production facilities"

Means "production equipment" and specially designed "software" therefor integrated into installations for "development" or for one or more phases of "production".

"Programmes"

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

"Radiation hardened"

Means that the component or equipment is designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (Si).

"Range"

The maximum distance that the specified rocket system or unmanned aerial vehicle (UAV) system is capable of travelling in the mode of stable flight as measured by the projection of its trajectory over the surface of the Earth.

Technical Notes:

- 1. The maximum capability based on the design characteristics of the system, when fully loaded with fuel or propellant, will be taken into consideration in determining "range".*
- 2. The "range" for both rocket systems and UAV systems will be determined independently of any external factors such as operational restrictions, limitations imposed by telemetry, data links or other external constraints.*
- 3. For rocket systems, the "range" will be determined using the trajectory that maximises "range", assuming ICAO standard atmosphere with zero wind.*
- 4. For UAV systems, the "range" will be determined for a one-way distance using the most fuel-efficient flight profile (e.g. cruise speed and altitude), assuming ICAO standard atmosphere with zero wind.*

"Software"

A collection of one or more "programmes", or "micro-programmes", fixed in any tangible medium of expression.

"Technology"

Means specific information which is required for the "development", "production" or "use" of a product. The information may take the form of "technical data" or "technical assistance".

"Technical assistance"

May take forms such as:

- instruction
- skills
- training
- working knowledge
- consulting services

"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

"Use"

Means:

- operation
- installation (including on-site installation)
- maintenance
- repair
- overhaul
- refurbishing

3. TERMINOLOGY

Where the following terms appear in the text, they are to be understood according to the explanations below:

- (a) "Specially designed" describes equipment, parts, components, materials or "software" which, as a result of "development", have unique properties that distinguish them for certain predetermined purposes. For example, a piece of equipment that is "specially designed" for use in a missile will only be considered so if it has no other function or use. Similarly, a piece of manufacturing equipment that is "specially designed" to produce a certain type of component will only be considered such if it is not capable of producing other types of components.
- (b) "Designed or modified" describes equipment, parts or components which, as a result of "development," or modification, have specified properties that make them fit for a particular application. "Designed or modified" equipment, parts, components or "software" can be used for other applications. For example, a titanium coated pump designed for a missile may be used with corrosive fluids other than propellants.
- (c) "Usable in", "usable for", "usable as" or "capable of" describes equipment, parts, components, materials or "software" which are suitable for a particular purpose. There is no need for the equipment, parts, components or "software" to have been configured, modified or specified for the particular purpose. For example, any military specification memory circuit would be "capable of" operation in a guidance system.
- (d) "Modified" in the context of "software" describes "software" which has been intentionally changed such that it has properties that make it fit for specified purposes or applications. Its properties may also make it suitable for purposes or applications other than those for which it was "modified".

CATEGORY I, ITEM 1**CATEGORY I****ITEM 1 COMPLETE DELIVERY SYSTEMS**

1.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS

1.A.1. Complete rocket systems (including ballistic missile systems, space launch vehicles, and sounding rockets) capable of delivering at least a 500 kg "payload" to a "range" of at least 300 km.

1.A.2. Complete unmanned aerial vehicle systems (including cruise missile systems, target drones and reconnaissance drones) capable of delivering at least a 500 kg "payload" to a "range" of at least 300 km.

1.B. TEST AND PRODUCTION EQUIPMENT

1.B.1. "Production facilities" specially designed for the systems specified in 1.A.

1.C. MATERIALS

None.

1.D. SOFTWARE

1.D.1. "Software" specially designed or modified for the "use" of "production facilities" specified in 1.B.

1.D.2. "Software" which coordinates the function of more than one subsystem, specially designed or modified for "use" in systems specified in 1.A.

1.E. TECHNOLOGY

1.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 1.A., 1.B., or 1.D.

CATEGORY I, ITEM 2**ITEM 2 COMPLETE SUBSYSTEMS USABLE FOR COMPLETE DELIVERY SYSTEMS****2.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS****2.A.1. Complete subsystems usable in the systems specified in 1.A., as follows:**

- a. Individual rocket stages usable in the systems specified in 1.A.;
- b. Re-entry vehicles, and equipment designed or modified therefor, usable in the systems specified in 1.A., as follows, except as provided in the Note below 2.A.1. for those designed for non-weapon payloads:
 1. Heat shields, and components therefor, fabricated of ceramic or ablative materials;
 2. Heat sinks and components therefor, fabricated of light-weight, high heat capacity materials;
 3. Electronic equipment specially designed for re-entry vehicles;
- c. **[Solid propellant rocket motors or liquid propellant rocket engines, usable in the systems specified in 1.A., having a total impulse capacity equal to or greater than 1.1×10^6 Ns;] Rocket propulsion subsystems, usable in the systems specified in 1.A., as follows:
 1. Solid propellant rocket motors or hybrid rocket motors having a total impulse capacity equal to or greater than 1.1×10^6 Ns;
 2. Liquid propellant rocket engines integrated, or designed or modified to be integrated, into a liquid propellant propulsion system which has a total impulse capacity equal to or greater than 1.1×10^6 Ns;**

Note:

Liquid propellant apogee engines [and] or station-keeping engines specified in 2.A.1.c.2., designed or modified for use on satellites, may be treated as Category II, if the subsystem is exported subject to end-use statements and quantity limits appropriate for the excepted end-use stated above, when having a vacuum thrust not greater than 1kN.

- d. 'Guidance sets', usable in the systems specified in 1.A., capable of achieving system accuracy of 3.33% or less of the "range" (e.g. a 'CEP' of 10 km or less at a "range" of 300 km), except as provided in the Note below 2.A.1. for those designed for missiles with a "range" under 300 km or manned aircraft;

Technical Notes:

1. A 'guidance set' integrates the process of measuring and computing a vehicle's position and velocity (i.e. navigation) with that of computing and sending commands to the vehicle's flight control systems to correct the trajectory.
 2. 'CEP' (circle of equal probability) is a measure of accuracy, defined as the radius of the circle centred at the target, at a specific range, in which 50% of the payloads impact.
- e. Thrust vector control sub-systems, usable in the systems specified in 1.A., except as provided in the Note below 2.A.1. for those designed for rocket systems that do not exceed the "range"/"payload" capability of systems specified in 1.A.;

Technical Note:

- 2.A.1.e. includes the following methods of achieving thrust vector control:
- a. Flexible nozzle;
 - b. Fluid or secondary gas injection;
 - c. Movable engine or nozzle;
 - d. Deflection of exhaust gas stream (jet vanes or probes);
 - e. Use of thrust tabs.
- f. Weapon or warhead safing, arming, fuzing, and firing mechanisms, usable in the systems specified in 1.A., except as provided in the Note below 2.A.1. for those designed for systems other than those specified in 1.A.

Note:

The exceptions in 2.A.1.b., 2.A.1.d., 2.A.1.e. and 2.A.1.f. above may be treated as Category II if the subsystem is exported subject to end-use statements and quantity limits appropriate for the excepted end-use stated above.

2.B. TEST AND PRODUCTION EQUIPMENT

2.B.1. "Production facilities" specially designed for the subsystems specified in 2.A.

2.B.2. "Production equipment" specially designed for the subsystems specified in 2.A.

2.C. MATERIALS

None.

2.D. SOFTWARE

2.D.1. "Software" specially designed or modified for the "use" of "production facilities" specified in 2.B.1.

2.D.2. "Software" specially designed or modified for the "use" of rocket motors or engines specified in 2.A.1.c.

2.D.3. "Software", specially designed or modified for the "use" of 'guidance sets' specified in 2.A.1.d.

Note:

2.D.3. includes "software", specially designed or modified to enhance the performance of 'guidance sets' to achieve or exceed the accuracy specified in 2.A.1.d.

2.D.4. "Software" specially designed or modified for the "use" of subsystems or equipment specified in 2.A.1.b.3.

2.D.5. "Software" specially designed or modified for the "use" of systems in 2.A.1.e.

2.D.6. "Software" specially designed or modified for the "use" of systems in 2.A.1.f.

Note:

Subject to end-use statements appropriate for the excepted end-use, "software" controlled by 2.D.2. [-] to 2.D.6. may be treated as Category II as follows:

- 1. Under 2.D.2. if specially designed or modified for liquid propellant apogee engines or station keeping engines, designed or modified for satellite applications as specified in the Note to 2.A.1.c.2.;*
- 2. Under 2.D.3. if designed for missiles with a "range" of under 300 km or manned aircraft;*
- 3. Under 2.D.4. if specially designed or modified for re-entry vehicles designed for non-weapon payloads;*
- 4. Under 2.D.5. if designed for rocket systems that do not exceed the "range" "payload" capability of systems specified in 1.A.;*
- 5. Under 2.D.6. if designed for systems other than those specified in 1.A.*

2.E. TECHNOLOGY

2.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 2.A., 2.B. or 2.D.

CATEGORY II, ITEM 3**CATEGORY II****ITEM 3 PROPULSION COMPONENTS AND EQUIPMENT****3.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS****3.A.1. Turbojet and turbofan engines, as follows:****a. Engines having both of the following characteristics:**

1. 'Maximum thrust value' greater than 400 N (achieved un-installed) excluding civil certified engines with a 'maximum thrust value' greater than 8.89 kN (achieved un-installed); and
2. Specific fuel consumption of 0.15 kg N⁻¹ h⁻¹ or less (at maximum continuous power at sea level static [**and standard**] conditions using the ICAO standard atmosphere);

Technical Note:

In 3.A.1.a.1., 'maximum thrust value' is the manufacturer's demonstrated maximum thrust for the engine type un-installed. The civil type certified thrust value will be equal to or less than the manufacturer's demonstrated maximum thrust for the engine type.

- b. Engines designed or modified for systems specified in 1.A. or 19.A.2., regardless of thrust or specific fuel consumption.

Note:

Engines specified in 3.A.1. may be exported as part of a manned aircraft or in quantities appropriate for replacement parts for a manned aircraft.

- 3.A.2. Ramjet/scramjet/pulse jet/'combined cycle engines', including devices to regulate combustion, and specially designed components therefor, usable in the systems specified in 1.A. or 19.A.2.

Technical Note:

In Item 3.A.2., 'combined cycle engines' are the engines that employ two or more cycles of the following types of engines: gas-turbine engine (turbojet, turboprop, turbofan and turboshaft), ramjet, scramjet, pulse jet, pulse detonation engine, rocket motor (liquid/solid-propellant and hybrid).

- 3.A.3. Rocket motor cases, 'insulation' components and nozzles therefor, usable in the systems specified in 1.A. or 19.A.1.

Technical Note:

In 3.A.3. 'insulation' intended to be applied to the components of a rocket motor, i.e. the case, nozzle inlets, case closures, includes cured or semi-cured compounded rubber components comprising sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps.

Note:

Refer to 3.C.2. for 'insulation' material in bulk or sheet form.

- 3.A.4. Staging mechanisms, separation mechanisms, and interstages therefor, usable in the systems specified in 1.A.

Note:

See also Item 11.A.5.

- 3.A.5. Liquid **[and]** slurry and gel propellant (including oxidisers) control systems, and specially designed components therefor, usable in the systems specified in 1.A., designed or modified to operate in vibration environments greater than 10 g rms between 20 Hz and 2 kHz.

Notes:

- 1. The only servo valves and pumps specified in 3.A.5. are the following:*

- a. *Servo valves designed for flow rates equal to or greater than 24 litres per minute, at an absolute pressure equal to or greater than 7 MPa, that have an actuator response time of less than 100 ms.*
 - b. *Pumps, for liquid propellants, with shaft speeds equal to or greater than 8,000 rpm or with discharge pressures equal to or greater than 7 MPa.*
2. *Systems and components specified in 3.A.5. may be exported as part of a satellite.*
- 3.A.6. **[Hybrid rocket motors and specially designed components therefor, usable in the systems specified in 1.A., 19.A.1. or 19.A.2.] Specially designed components for hybrid rocket motors specified in 2.A.1.c. and 20.A.1.b.**
- 3.A.7. Radial ball bearings having all tolerances specified in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9 or other national equivalents), or better and having all the following characteristics:
 - a. An inner ring bore diameter between 12 and 50 mm;
 - b. An outer ring outside diameter between 25 and 100 mm; and
 - c. A width between 10 and 20 mm.
- 3.A.8. Liquid propellant tanks specially designed for the propellants controlled in Item 4.C. or other liquid propellants used in the systems specified in 1.A.1.
- 3.A.9. 'Turboprop engine systems' specially designed for the systems in 1.A.2. or 19.A.2., and specially designed components therefor, having a maximum power greater than 10 kW (achieved uninstalled at sea level **[standard]** static conditions using the ICAO standard atmosphere), excluding civil certified engines.

Technical Note:

For the purposes of Item 3.A.9., a 'turboprop engine system' incorporates all of the following:

- a. Turboshaft engine; and*
- b. Power transmission system to transfer the power to a propeller.*

3.B. TEST AND PRODUCTION EQUIPMENT

- 3.B.1. "Production facilities" specially designed for equipment or materials specified in 3.A.1., 3.A.2., 3.A.3., 3.A.4., 3.A.5., 3.A.6., 3.A.8., 3.A.9. or 3.C.
- 3.B.2. "Production equipment" specially designed for equipment or materials specified in 3.A.1., 3.A.2., 3.A.3., 3.A.4., 3.A.5., 3.A.6., 3.A.8., 3.A.9. or 3.C.
- 3.B.3. Flow-forming machines, and specially designed components therefor, which:
 - a. According to the manufacturers technical specification can be equipped with numerical control units or a computer control, even when not equipped with such units at delivery; and
 - b. Have more than two axes which can be co-ordinated simultaneously for contouring control.

Note:

This item does not include machines that are not usable in the "production" of propulsion components and equipment (e.g. motor cases) for systems specified in 1.A.

Technical Note:

Machines combining the function of spin-forming and flow-forming are, for the purpose of this item, regarded as flow-forming machines.

3.C. MATERIALS

- 3.C.1. 'Interior lining' usable for rocket motor cases in the systems specified in 1.A. or specially designed for systems specified in 19.A.1. or 19.A.2.

Technical Note:

In 3.C.1. 'interior lining' suited for the bond interface between the solid propellant and the case or insulating liner is usually a liquid polymer based dispersion of refractory or insulating materials e.g. carbon filled HTPB or other polymer with added curing agents to be sprayed or screeded over a case interior.

- 3.C.2. 'Insulation' material in bulk form usable for rocket motor cases in the systems specified in 1.A. or specially designed for systems specified in 19.A.1. or 19.A.2.

Technical Note:

In 3.C.2. 'insulation' intended to be applied to the components of a rocket motor, i.e. the case, nozzle inlets, case closures, includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps specified in 3.A.3.

3.D. SOFTWARE

- 3.D.1. "Software" specially designed or modified for the "use" of "production facilities" and flow forming machines specified in 3.B.1. or 3.B.3.
- 3.D.2. "Software" specially designed or modified for the "use" of equipment specified in 3.A.1., 3.A.2., 3.A.4., 3.A.5., 3.A.6. or 3.A.9.

Notes:

1. "Software" specially designed or modified for the "use" of engines specified in 3.A.1. may be exported as part of a manned aircraft or as replacement "software" therefor.
2. "Software" specially designed or modified for the "use" of propellant control systems specified in 3.A.5. may be exported as part of a satellite or as replacement "software" therefor.

3.D.3. "Software" specially designed or modified for the "development" of equipment specified in 3.A.2., 3.A.3. or 3.A.4.

3.E. TECHNOLOGY

3.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment, materials or "software" specified in 3.A.1., 3.A.2., 3.A.3., 3.A.4., 3.A.5., 3.A.6., 3.A.8., 3.A.9., 3.B., 3.C. or 3.D.

CATEGORY II, ITEM 4**ITEM 4 PROPELLANTS, CHEMICALS AND PROPELLANT PRODUCTION****4.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

None.

4.B. TEST AND PRODUCTION EQUIPMENT

4.B.1. "Production equipment", and specially designed components therefor, for the "production", handling or acceptance testing of liquid propellants or propellant constituents specified in 4.C.

4.B.2. "Production equipment", other than that described in 4.B.3., and specially designed components therefor, for the production, handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents specified in 4.C.

4.B.3. Equipment as follows, and specially designed components therefor:

a. Batch mixers with provision for mixing under vacuum in the range of zero to 13.326 kPa and with temperature control capability of the mixing chamber and having all of the following:

1. A total volumetric capacity of 110 litres or more; and
2. At least one 'mixing/kneading shaft' mounted off centre;

Note:

In Item 4.B.3.a.2. the term 'mixing/kneading shaft' does not refer to deagglomerators or knife-spindles.

b. Continuous mixers with provision for mixing under vacuum in the range of zero to 13.326 kPa and with a temperature control capability of the mixing chamber having any of the following:

1. Two or more mixing/kneading shafts; or

2. A single rotating shaft which oscillates and having kneading teeth/pins on the shaft as well as inside the casing of the mixing chamber;
- c. Fluid energy mills usable for grinding or milling substances specified in 4.C.;
- d. Metal powder "production equipment" usable for the "production", in a controlled environment, of spherical, spheroidal or atomised materials specified in 4.C.2.c., 4.C.2.d. or 4.C.2.e.

Note:

4.B.3.d. includes:

- a. Plasma generators (high frequency arc-jet) usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;*
- b. Electrobust equipment usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;*
- c. Equipment usable for the "production" of spherical aluminium powders by powdering a melt in an inert medium (e.g. nitrogen).*

Notes:

- 1. The only batch mixers, continuous mixers, usable for solid propellants or propellants constituents specified in 4.C., and fluid energy mills specified in 4.B., are those specified in 4.B.3.*
- 2. Forms of metal powder "production equipment" not specified in 4.B.3.d. are to be evaluated in accordance with 4.B.2.*

4.C. MATERIALS

4.C.1. Composite and composite modified double base propellants.

4.C.2. Fuel substances as follows:

a. Hydrazine (CAS 302-01-2) with a concentration of more than 70%;

b. Hydrazine derivatives as follows:

1. Monomethylhydrazine (MMH) (CAS 60-34-4);
2. Unsymmetrical dimethylhydrazine (UDMH) (CAS 57-14-7);
3. Hydrazine mononitrate;
4. Trimethylhydrazine (CAS 1741-01-1);
5. Tetramethylhydrazine (CAS 6415-12-9);
6. N,N diallylhydrazine;
7. Allylhydrazine (CAS 7422-78-8);
8. Ethylene dihydrazine;
9. Monomethylhydrazine dinitrate;
10. Unsymmetrical dimethylhydrazine nitrate;
11. Hydrazinium azide (CAS 14546-44-2);
12. Dimethylhydrazinium azide;
13. Hydrazinium dinitrate;
14. Diimido oxalic acid dihydrazine (CAS 3457-37-2);
15. 2-hydroxyethylhydrazine nitrate (HEHN);
16. Hydrazinium perchlorate (CAS 27978-54-7);
17. Hydrazinium diperchlorate (CAS 13812-39-0);
18. Methylhydrazine nitrate (MHN);
19. Diethylhydrazine nitrate (DEHN);
20. 3,6-dihydrazino tetrazine nitrate (DHTN);

Technical note:

*3,6-dihydrazino tetrazine nitrate is also referred to as
1,4-dihydrazine nitrate*

c. Spherical or spheroidal aluminium powder (CAS 7429-90-5) [**with particles of uniform diameter**] in particle size of less than 200×10^{-6} m (200 μ m) and an aluminium content of 97% by weight or more, if at least 10% of the total weight is made up of particles of less than 63 μ m, according to ISO 2591:1988 or national equivalents [**such as JIS Z8820**];

Technical Note:

A particle size of 63 µm (ISO R-565) corresponds to 250 mesh (Tyler) or 230 mesh (ASTM standard E-11).

- d. **[Zirconium]** Metal powders of any of the following: zirconium (CAS 7440-67-7), beryllium (CAS 7440-41-7), magnesium (CAS 7439-95-4) [and] or alloys of these, [in] if at least 90% of the total particles by particle [size] volume or weight are made up of particles of less than [60 x 10⁻⁶ m] 60 µm (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomised, spheroidal, flaked or ground, consisting of 97% by weight or more of any of the above mentioned metals;

Note:

In a multimodal particle distribution (e.g. mixtures of different grain sizes) in which one or more modes are controlled, the entire powder mixture is controlled.

Technical Note:

The natural content of hafnium (CAS 7440-58-6) in the zirconium (typically 2% to 7%) is counted with the zirconium.

- e. **[Boron]** Metal powders of either boron (CAS 7440-42-8) [and] or boron alloys [in] with a boron content of 85% or more by weight, if at least 90% of the total particles by particle [size] volume or weight are made up of particles of less than [60 x 10⁻⁶ m] 60 µm (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomised, spheroidal, flaked or ground [with a purity of 85 % by weight or more];

Note:

In a multimodal particle distribution (e.g. mixtures of different grain sizes) in which one or more modes are controlled, the entire powder mixture is controlled.

f. High energy density materials [**such as boron slurry, having an energy density density of 40×10^6 J/kg or greater;**], usable in the systems specified in 1.A. or 19.A., as follows:

1. Mixed fuels that incorporate both solid and liquid fuels, such as boron slurry, having a mass- based energy density of 40×10^6 J/kg or greater;

2. Other high energy density fuels and fuel additives (e.g., cubane, ionic solutions, JP-10) having a volume-based energy density of 37.5×10^9 J/m³ or greater, measured at 20°C and one atmosphere (101.325 kPa) pressure.

Note:

Item 4.C.2.f.2. does not control fossil refined fuels and biofuels produced from vegetables, including fuels for engines certified for use in civil aviation, unless specifically formulated for systems specified in 1.A. or 19.A.

4.C.3. Oxidisers/Fuels as follows:

Perchlorates, chlorates or chromates mixed with powdered metals or other high energy fuel components.

4.C.4. Oxidiser substances as follows:

a. Oxidiser substances usable in liquid propellant rocket engines as follows:

1. Dinitrogen trioxide (CAS 10544-73-7);
2. Nitrogen dioxide (CAS 10102-44-0) / dinitrogen tetroxide (CAS 10544-72-6);
3. Dinitrogen pentoxide (CAS 10102-03-1);
4. Mixed Oxides of Nitrogen (MON);
5. Inhibited Red Fuming Nitric Acid (IRFNA) (CAS 8007-58-7);
6. Compounds composed of fluorine and one or more of other halogens, oxygen or nitrogen;

Note:

Item 4.C.4.a.6. does not control Nitrogen Trifluoride (NF₃) (CAS 7783-54-2) in a gaseous state as it is not usable for missile applications.

Technical Note:

Mixed Oxides of Nitrogen (MON) are solutions of Nitric Oxide (NO) in Dinitrogen Tetroxide/Nitrogen Dioxide (N₂O₄/NO₂) that can be used in missile systems. There are a range of compositions that can be denoted as MON_i or MON_{ij} where *i* and *j* are integers representing the percentage of Nitric Oxide in the mixture (e.g. MON₃ contains 3% Nitric Oxide, MON₂₅ 25% Nitric Oxide. An upper limit is MON₄₀, 40% by weight).

[Note:

Item 4.C.4.a.6. does not control Nitrogen Trifluoride (NF₃) (CAS 7783-54-2) in a gaseous state as it is not usable for missile applications.]

- b. Oxidiser substances usable in solid propellant rocket motors as follows:
1. Ammonium perchlorate (AP) (CAS 7790-98-9);
 2. Ammonium dinitramide (ADN) (CAS 140456-78-6);
 3. Nitro-amines (cyclo-tetramethylene - tetranitramine (HMX) (CAS 2691-41-0); cyclo-trimethylene - trinitramine (RDX) (CAS 121-82-4);
 4. Hydrazinium nitroformate (HNF) (CAS 20773-28-8);
 5. 2,4,6,8,10,12-Hexanitrohexaazaisowurtzitane (CL-20) (CAS 135285-90-4).

4.C.5. Polymeric substances, as follows:

- a. Carboxy - terminated polybutadiene (including carboxyl - terminated polybutadiene) (CTPB);
- b. Hydroxy - terminated polybutadiene (including hydroxyl - terminated polybutadiene) (HTPB);
- c. Glycidyl azide polymer (GAP);

- d. Polybutadiene - Acrylic Acid (PBAA);
- e. Polybutadiene - Acrylic Acid - Acrylonitrile (PBAN);
- f. Polytetrahydrofuran polyethylene glycol (TPEG).

Technical Note:

Polytetrahydrofuran polyethylene glycol (TPEG) is a block co-polymer of poly 1,4-Butanediol and polyethylene glycol (PEG).

4.C.6. Other propellant additives and agents as follows:

a. Bonding agents as follows:

1. Tris (1-(2-methyl)aziridiny) phosphine oxide (MAPO) (CAS 57-39-6);
2. 1,1',1''-trimesoyl-tris(2-ethylaziridine) (HX-868, BITA) (CAS 7722-73-8);
3. Tepanol (HX-878), reaction product of tetraethylenepentamine, acrylonitrile and glycidol (CAS 68412-46-4);
4. Tepan (HX-879), reaction product of tetraethylenepentamine and acrylonitrile (CAS 68412-45-3);
5. Polyfunctional aziridine amides with isophthalic, trimesic, isocyanuric, or trimethyladipic backbone also having a 2-methyl or 2-ethyl aziridine group;

Note:

Item 4.C.6.a.5. includes:

1. 1,1'-Isophthaloyl-bis(2-methylaziridine) (HX-752) (CAS 7652-64-4);
2. 2,4,6-tris(2-ethyl-1-aziridiny)-1,3,5-triazine (HX-874) (CAS 18924-91-9);
3. 1,1'-trimethyladipoylbis(2-ethylaziridine) (HX-877) (CAS 71463-62-2).

b. Curing reaction catalysts as follows:

Triphenyl bismuth (TPB) (CAS 603-33-8);

- c. Burning rate modifiers, as follows:
1. Carboranes, decaboranes, pentaboranes and derivatives thereof;
 2. Ferrocene derivatives, as follows:
 - a. Catocene (CAS 37206-42-1);
 - b. Ethyl ferrocene (CAS 1273-89-8);
 - c. Propyl ferrocene;
 - d. n-Butyl ferrocene (CAS 31904-29-7);
 - e. Pentyl ferrocene (CAS 1274-00-6);
 - f. Dicyclopentyl ferrocene;
 - g. Dicyclohexyl ferrocene;
 - h. Diethyl ferrocene (CAS 1273-97-8);
 - i. Dipropyl ferrocene;
 - j. Dibutyl ferrocene (CAS 1274-08-4);
 - k. Dihexyl ferrocene (CAS 93894-59-8);
 - l. Acetyl ferrocene[s] (CAS 1271-55-2) / 1,1'-diacetyl ferrocene (CAS 1273-94-5);
 - m. Ferrocene carboxylic acid[s] (CAS 1271-42-7) / 1,1'-Ferrocenedicarboxylic acid (CAS 1293-87-4);
 - n. Butacene (CAS 125856-62-4);
 - o. Other ferrocene derivatives usable as rocket propellant burning rate modifiers;

Note:

Item 4.C.6.c.2.o. does not control ferrocene derivatives that contain a six carbon aromatic functional group attached to the ferrocene molecule.

- d. Esters and plasticisers as follows:
1. Triethylene glycol dinitrate (TEGDN) (CAS 111-22-8);
 2. Trimethylolethane trinitrate (TMETN) (CAS 3032-55-1);
 3. 1,2,4-butanetriol trinitrate (BTTN) (CAS 6659-60-5);
 4. Diethylene glycol dinitrate (DEGDN) (CAS 693-21-0);
 5. 4,5 diazidomethyl-2-methyl-1,2,3-triazole (iso- DAMTR);
 6. Nitraoethylnitramine (NENA) based plasticisers, as follows:
 - a. Methyl-NENA (CAS 17096-47-8);
 - b. Ethyl-NENA (CAS 85068-73-1);

- c. Butyl-NENA (CAS 82486-82-6);
- 7. Dinitropropyl based plasticisers, as follows:
 - a. Bis (2,2-dinitropropyl) acetal (BDNPA) (CAS 5108-69-0);
 - b. Bis (2,2-dinitropropyl) formal (BDNPF) (CAS 5917-61-3);

- e. Stabilisers as follows:
 - 1. 2-Nitrodiphenylamine (CAS 119-75-5);
 - 2. N-methyl-p-nitroaniline (CAS 100-15-2).

4.D. SOFTWARE

- 4.D.1. "Software" specially designed or modified for the **["use"]** operation or maintenance of equipment specified in 4.B. for the "production" and handling of materials specified in 4.C.

4.E. TECHNOLOGY

- 4.E.1 "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or materials specified in 4.B. and 4.C.

CATEGORY II, ITEM 5

RESERVED FOR FUTURE USE

CATEGORY II, ITEM 6**ITEM 6 PRODUCTION OF STRUCTURAL COMPOSITES, PYROLYTIC DEPOSITION AND DENSIFICATION, AND STRUCTURAL MATERIALS****6.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

6.A.1. Composite structures, laminates, and manufactures thereof, specially designed for use in the systems specified in 1.A., 19.A.1. or 19.A.2. and the subsystems specified in 2.A. or 20.A.

6.A.2. Resaturated pyrolised (i.e. carbon-carbon) components having all of the following:

- a. Designed for rocket systems; and
- b. Usable in the systems specified in 1.A. or 19.A.1.

6.B. TEST AND PRODUCTION EQUIPMENT

6.B.1. Equipment for the "production" of structural composites, fibres, prepregs or preforms, usable in the systems specified in 1.A., 19.A.1. or 19.A.2., as follows, and specially designed components, and accessories therefor:

- a. Filament winding machines or fibre placement machines, of which the motions for positioning, wrapping and winding fibres can be co-ordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from fibrous or filamentary materials, and co-ordinating and programming controls;
- b. Tape-laying machines of which the motions for positioning and laying tape and sheets can be co-ordinated and programmed in two or more axes, designed for the manufacture of composite airframes and missile structures;
- c. Multi-directional, multi-dimensional weaving machines or interlacing machines, including adapters and modification kits for weaving, interlacing or braiding fibres to manufacture composite structures;

Note:

6.B.1.c. does not control textile machinery not modified for the end-uses stated.

- d. Equipment designed or modified for the production of fibrous or filamentary materials as follows:
1. Equipment for converting polymeric fibres (such as polyacrylonitrile, rayon, or polycarbosilane) including special provision to strain the fibre during heating;
 2. Equipment for the vapour deposition of elements or compounds on heated filament substrates;
 3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);
- e. Equipment designed or modified for special fibre surface treatment or for producing prepregs and preforms, including rollers, tension stretchers, coating equipment, cutting equipment and clicker dies.

Note:

Examples of components and accessories for the machines specified in 6.B.1. are moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.

- 6.B.2. Nozzles specially designed for the processes referred to in 6.E.3.
- 6.B.3. Isostatic presses having all of the following characteristics:
- a. Maximum working pressure equal to or greater than 69 MPa;
 - b. Designed to achieve and maintain a controlled thermal environment of 600°C or greater; and
 - c. Possessing a chamber cavity with an inside diameter of 254 mm or greater.

- 6.B.4. Chemical vapour deposition furnaces designed or modified for the densification of carbon-carbon composites.
- 6.B.5. Equipment and process controls, other than those specified in 6.B.3. or 6.B.4., designed or modified for densification and pyrolysis of structural composite rocket nozzles and re-entry vehicle nose tips.

6.C. MATERIALS

- 6.C.1. Resin impregnated fibre prepregs and metal coated fibre preforms, for the goods specified in 6.A.1., made either with organic matrix or metal matrix utilising fibrous or filamentary reinforcements having a specific tensile strength greater than 7.62×10^4 m and a specific modulus greater than 3.18×10^6 m.

Note:

The only resin impregnated fibre prepregs specified in 6.C.1. are those using resins with a glass transition temperature (T_g), after cure, exceeding 145°C as determined by ASTM D4065 or national equivalents.

Technical Notes:

1. *In Item 6.C.1. 'specific tensile strength' is the ultimate tensile strength in N/m² divided by the specific weight in N/m³, measured at a temperature of (296 ± 2)K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*
2. *In Item 6.C.1. 'specific modulus' is the Young's modulus in N/m² divided by the specific weight in N/m³, measured at a temperature of (296 ± 2)K ((23 ± 2)°C) and a relative humidity of (50 ± 5)%.*

- 6.C.2. Resaturated pyrolysed (i.e. carbon-carbon) materials having all of the following:
- a. Designed for rocket systems; and
 - b. Usable in the systems specified in 1.A. or 19.A.1.

- 6.C.3. Fine grain graphites with a bulk density of at least 1.72 g/cc measured at 15°C and having a grain size of 100×10^{-6} m (100 µm) or less, usable for rocket nozzles and re-entry vehicle nose tips, which can be machined to any of the following products:
- a. Cylinders having a diameter of 120 mm or greater and a length of 50 mm or greater;
 - b. Tubes having an inner diameter of 65 mm or greater and a wall thickness of 25 mm or greater and a length of 50 mm or greater; or
 - c. Blocks having a size of 120 mm x 120 mm x 50 mm or greater.
- 6.C.4. Pyrolytic or fibrous reinforced graphites usable for rocket nozzles and re-entry vehicle nose tips usable in systems specified in 1.A. or 19.A.1.
- 6.C.5. Ceramic composite materials (dielectric constant less than 6 at any frequency from 100 MHz to 100 GHz) for use in missile radomes usable in systems specified in 1.A. or 19.A.1.
- 6.C.6. Silicon-carbide materials as follows:
- a. Bulk machinable silicon-carbide reinforced unfired ceramic usable for nose tips usable in systems specified in 1.A. or 19.A.1.;
 - b. Reinforced silicon-carbide ceramic composites usable for nose tips, re-entry vehicles, nozzle flaps, usable in systems specified in 1.A. or 19.A.1.
- 6.C.7. **[Tungsten, molybdenum, and alloys of these metals in the form of uniform spherical or atomised particles of 500×10^{-6} m (500 µm) diameter or less with a purity of 97% or higher for fabrication of rocket motor components, i.e. heat shields, nozzle substrates, nozzle throats, and thrust vector control surfaces, usable in systems specified in 1.A. or 19.A.1.] Materials for the fabrication of missile components in the systems specified in 1.A., 19.A.1. or 19.A.2, as follows:**

- a. Tungsten and alloys in particulate form with a tungsten content of 97% by weight or more and a particle size of 50×10^{-6} m (50 μ m) or less;
- b. Molybdenum and alloys in particulate form with a molybdenum content of 97% by weight or more and a particle size of 50×10^{-6} m (50 μ m) or less;
- c. Tungsten materials in the solid form having all of the following:
 1. Any of the following material compositions:
 - i. Tungsten and alloys containing 97% by weight or more of tungsten;
 - ii. Copper infiltrated tungsten containing 80% by weight or more of tungsten; or
 - iii. Silver infiltrated tungsten containing 80% by weight or more of tungsten; and
 2. Able to be machined to any of the following products:
 - i. Cylinders having a diameter of 120 mm or greater and a length of 50 mm or greater;
 - ii. Tubes having an inner diameter of 65 mm or greater and a wall thickness of 25 mm or greater and a length of 50 mm or greater; or
 - iii. Blocks having a size of 120 mm x 120 mm x 50 mm or greater.

6.C.8. [Maraging steels having an ultimate tensile strength equal to or greater than 1.5 GPa, measured at 20°C, in the form of sheet, plate or tubing with a wall or plate thickness equal to or less than 5.0 mm usable in systems specified in 1.A. or 19.A.1.] Maraging steels, usable in the systems specified in 1.A. or 19.A.1., having all of the following:

- a. Having an ultimate tensile strength, measured at 20°C, equal to or greater than:
 1. 0.9 GPa in the solution annealed stage; or
 2. 1.5 GPa in the precipitation hardened stage; and
- b. Any of the following forms:
 1. Sheet, plate or tubing with a wall or plate thickness equal to or less than 5.0 mm; or

2. Tubular forms with a wall thickness equal to or less than 50 mm and having an inner diameter equal to or greater than 270 mm.

Technical Note:

Maraging steels are iron alloys [generally]:

- a. Generally characterised by high nickel, very low carbon content and use substitutional elements or precipitates to produce strengthening and age-hardening of the alloy; and*
- b. Subjected to heat treatment cycles to facilitate the martensitic transformation process (solution annealed stage) and subsequently age hardened (precipitation hardened stage).*

6.C.9. Titanium-stabilized duplex stainless steel (Ti-DSS) usable in the systems specified in 1.A. or 19.A.1. and having all of the following:

- a. Having all of the following characteristics:
1. Containing 17.0 - 23.0 weight percent chromium and 4.5 - 7.0 weight percent nickel;
 2. Having a titanium content of greater than 0.10 weight percent; and
 3. A ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10% is austenite by volume (according to ASTM E-1181-87 or national equivalents); and
- b. Any of the following forms:
1. Ingots or bars having a size of 100 mm or more in each dimension;
 2. Sheets having a width of 600 mm or more and a thickness of 3 mm or less; or
 3. Tubes having an outer diameter of 600 mm or more and a wall thickness of 3 mm or less.

6.D. SOFTWARE

6.D.1. "Software" specially designed or modified for the [**“use”**] operation or maintenance of equipment specified in 6.B.1.

- 6.D.2. "Software" specially designed or modified for the equipment specified in 6.B.3., 6.B.4. or 6.B.5.
- 6.E. TECHNOLOGY
- 6.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment, materials or "software" specified in 6.A., 6.B., 6.C. or 6.D.
- 6.E.2. "Technical data" (including processing conditions) and procedures for the regulation of temperature, pressures or atmosphere in autoclaves or hydroclaves when used for the production of composites or partially processed composites, usable for equipment or materials specified in 6.A. or 6.C.
- 6.E.3. "Technology" for producing pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1,300°C to 2,900°C temperature range at pressures of 130 Pa (1 mm Hg) to 20 kPa (150 mm Hg) including "technology" for the composition of precursor gases, flow-rates, and process control schedules and parameters.

CATEGORY II, ITEM 7

RESERVED FOR FUTURE USE

CATEGORY II, ITEM 8

RESERVED FOR FUTURE USE

CATEGORY II, ITEM 9**ITEM 9 INSTRUMENTATION, NAVIGATION AND DIRECTION FINDING****9.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 9.A.1. Integrated flight instrument systems which include gyrostabilisers or automatic pilots, designed or modified for use in the systems specified in 1.A., or 19.A.1. or 19.A.2. and specially designed components therefor.
- 9.A.2. Gyro-astro compasses and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites, and specially designed components therefor.
- 9.A.3. Linear accelerometers, designed for use in inertial navigation systems or in guidance systems of all types, usable in the systems specified in 1.A., 19.A.1. or 19.A.2., having all of the following characteristics, and specially designed components therefor:
- a. 'Scale factor' 'repeatability' less (better) than 1250 ppm; and
 - b. 'Bias' 'repeatability' less (better) than 1250 micro g.

Note:

Item 9.A.3. does not control accelerometers specially designed and developed as Measurement While Drilling (MWD) sensors for use in downhole well service operations.

Technical Notes:

1. 'Bias' is defined as the accelerometer output when no acceleration is applied.
2. 'Scale factor' is defined as the ratio of change in output to a change in the input.
3. The measurement of 'bias' and 'scale factor' refers to one sigma standard deviation with respect to a fixed calibration over a period of one year.

4. *'Repeatability' is defined according to IEEE Standard for Inertial Sensor Terminology [528-2001] in the Definitions section paragraph 2.214 titled repeatability (gyro, accelerometer) as follows:*

'The closeness of agreement among repeated measurements of the same variable under the same operating conditions when changes in conditions or non-operating periods occur between measurements'.

[Note:

Item 9.A.3. does not control accelerometers specially designed and developed as Measurement While Drilling (MWD) sensors for use in downhole well service operations.]

9.A.4. All types of gyros usable in the systems specified in 1.A., 19.A.1 or 19.A.2., with a rated 'drift rate' 'stability' of less than 0.5 degrees (1 sigma or rms) per hour in a 1 g environment, and specially designed components therefor.

Technical Notes:

1. *'Drift rate' is defined as the component of gyro output that is functionally independent of input rotation and is expressed as an angular rate. (IEEE STD 528-2001 paragraph 2.56)*

2. *'Stability' is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition. (This definition does not refer to dynamic or servo stability.) (IEEE STD 528-2001 paragraph 2.247)*

9.A.5. Accelerometers or gyros of any type, designed for use in inertial navigation systems or in guidance systems of all types, specified to function at acceleration levels greater than 100 g, and specially designed components therefor.

Note :

9.A.5. does not include accelerometers that are designed to measure vibration or shock.

- 9.A.6. Inertial or other equipment using accelerometers specified in 9.A.3. or 9.A.5. or gyros specified in 9.A.4. or 9.A.5., and systems incorporating such equipment, and specially designed components therefor.
- 9.A.7. 'Integrated navigation systems', designed or modified for the systems specified in 1.A., 19.A.1. or 19.A.2. and capable of providing a navigational accuracy of 200 m CEP or less.

Technical Note:

An 'integrated navigation system' typically incorporates all of the following components:

- a. An inertial measurement device (e.g. an attitude and heading reference system, inertial reference unit, or inertial navigation system);*
- b. One or more external sensors used to update the position and/or velocity, either periodically or continuously throughout the flight (e.g. satellite navigation receiver, radar altimeter, and/or Doppler radar); and*
- c. Integration hardware and software.*

N.B. For integration "software", see Item 9.D.4.

- 9.A.8. Three axis magnetic heading sensors having all of the following characteristics, and specially designed components therefor:
- a. Internal tilt compensation in pitch (+/- 90 degrees) and having roll (+/- 180 degrees) axes.
 - b. Capable of providing azimuthal accuracy better (less) than 0.5 degrees rms at latitudes of +/- 80 degrees, referenced to local magnetic field; and
 - c. Designed or modified to be integrated with flight control and navigation systems.

Note:

Flight control and navigation systems in Item 9.A.8. include gyrostabilisers, automatic pilots and inertial navigation systems.

9.B. TEST AND PRODUCTION EQUIPMENT

- 9.B.1. "Production equipment", and other test, calibration and alignment equipment, other than that described in 9.B.2., designed or modified to be used with equipment specified in 9.A.

Note:

Equipment specified in 9.B.1. includes the following:

- a. *For laser gyro equipment, the following equipment used to characterise mirrors, having the threshold accuracy shown or better:*

1. *Scatterometer (10 ppm);*
2. *Reflectometer (50 ppm);*
3. *Profilometer (5 Angstroms);*

- b. *For other inertial equipment:*

1. *Inertial Measurement Unit (IMU) Module Tester;*
2. *IMU Platform Tester;*
3. *IMU Stable Element Handling Fixture;*
4. *IMU Platform Balance Fixture;*
5. *Gyro Tuning Test Station;*
6. *Gyro Dynamic Balance Station;*
7. *Gyro Run-In/Motor Test Station;*
8. *Gyro Evacuation and Filling Station;*
9. *Centrifuge Fixture for Gyro Bearings;*
10. *Accelerometer Axis Align Station;*
11. *Accelerometer Test Station;*
12. *Fiber Optic Gyro Coil Winding Machines.*

- 9.B.2. Equipment as follows:

- a. Balancing machines having all the following characteristics:

1. Not capable of balancing rotors/assemblies having a mass greater than 3 kg;
2. Capable of balancing rotors/assemblies at speeds greater than 12,500 rpm;
3. Capable of correcting unbalance in two planes or more; and

4. Capable of balancing to a residual specific unbalance of 0.2 g mm per kg of rotor mass;
- b. Indicator heads (sometimes known as balancing instrumentation) designed or modified for use with machines specified in 9.B.2.a.;
- c. Motion simulators/rate tables (equipment capable of simulating motion) having all of the following characteristics:
 1. Two axes or more;
 2. Designed or modified to incorporate sliprings or integrated non-contact devices capable of transferring electrical power, signal information, or both; and
 3. Having any of the following characteristics:
 - a. For any single axis having all of the following:
 1. Capable of rates of 400 degrees/s or more, or 30 degrees/s or less; and
 2. A rate resolution equal to or less than 6 degrees/s and an accuracy equal to or less than 0.6 degrees/s;
 - b. Having a worst-case rate stability equal to or better (less) than plus or minus 0.05% averaged over 10 degrees or more; or
 - c. A positioning "accuracy" equal to or less (better) than 5 arc second;
- d. Positioning tables (equipment capable of precise rotary positioning in any axes) having the following characteristics:
 1. Two axes or more; and
 2. A positioning "accuracy" equal to or less (better) than 5 arc second;
- e. Centrifuges capable of imparting accelerations above 100 g and designed or modified to incorporate sliprings or integrated non-contact devices capable of transferring electrical power, signal information, or both.

Notes:

1. *The only balancing machines, indicator heads, motion simulators, rate tables, positioning tables and centrifuges specified in Item 9 are those specified in 9.B.2.*

2. *9.B.2.a. does not control balancing machines designed or modified for dental or other medical equipment.*
3. *9.B.2.c. and 9.B.2.d. do not control rotary tables designed or modified for machine tools or for medical equipment.*
4. *Rate tables not controlled by 9.B.2.c. and providing the characteristics of a positioning table are to be evaluated according to 9.B.2.d.*
5. *Equipment that has the characteristics specified in 9.B.2.d. which also meets the characteristics of 9.B.2.c. will be treated as equipment specified in 9.B.2.c.*
6. *Item 9.B.2.c. applies whether or not slippings or integrated non-contact devices are fitted at the time of export.*
7. *Item 9.B.2.e. applies whether or not slippings or integrated non-contact devices are fitted at the time of export.*

9.C. MATERIALS

None.

9.D. SOFTWARE

- 9.D.1. "Software" specially designed or modified for the "use" of equipment specified in 9.A. or 9.B.
- 9.D.2. Integration "software" for the equipment specified in 9.A.1.
- 9.D.3. Integration "software" specially designed for the equipment specified in 9.A.6.
- 9.D.4. Integration "software", designed or modified for the 'integrated navigation systems' specified in 9.A.7.

Note:

A common form of integration "software" employs Kalman filtering.

9.E. TECHNOLOGY

- 9.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 9.A., 9.B. or 9.D.

Note:

Equipment or "software" specified in 9.A. or 9.D. may be exported as part of a manned aircraft, satellite, land vehicle, marine/submarine vessel or geophysical survey equipment or in quantities appropriate for replacement parts for such applications.

CATEGORY II, ITEM 10**ITEM 10 FLIGHT CONTROL****10.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 10.A.1. Hydraulic, mechanical, electro-optical, or electromechanical flight control systems (including fly-by-wire systems) designed or modified for the systems specified in 1.A.
- 10.A.2. Attitude control equipment designed or modified for the systems specified in 1.A.
- 10.A.3. Flight control servo valves designed or modified for the systems in 10.A.1. or 10.A.2., and designed or modified to operate in a vibration environment greater than 10 g rms between 20 Hz and 2 kHz.

Note:

Systems, equipment or valves specified in 10.A. may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

10.B. TEST AND PRODUCTION EQUIPMENT

- 10.B.1. Test, calibration, and alignment equipment specially designed for equipment specified in 10.A.

10.C. MATERIALS

None.

10.D. SOFTWARE

- 10.D.1. "Software" specially designed or modified for the "use" of equipment specified in 10.A. or 10.B.

Note:

"Software" specified in 10.D.1. may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

10.E. TECHNOLOGY

- 10.E.1. Design "technology" for integration of air vehicle fuselage, propulsion system and lifting control surfaces, designed or modified for the systems specified in 1.A. or 19.A.2., to optimise aerodynamic performance throughout the flight regime of an unmanned aerial vehicle.
- 10.E.2. Design "technology" for integration of the flight control, guidance, and propulsion data into a flight management system, designed or modified for the systems specified in 1.A. or 19.A.1., for optimisation of rocket system trajectory.
- 10.E.3. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 10.A., 10.B. or 10.D.

CATEGORY II, ITEM 11**ITEM 11 AVIONICS****11.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 11.A.1. Radar and laser radar systems, including altimeters, designed or modified for use in the systems specified in 1.A.

Technical Note:

Laser radar systems embody specialised transmission, scanning, receiving and signal processing techniques for utilisation of lasers for echo ranging, direction finding and discrimination of targets by location, radial speed and body reflection characteristics.

- 11.A.2. Passive sensors for determining bearings to specific electromagnetic sources (direction finding equipment) or terrain characteristics, designed or modified for use in the systems specified in 1.A.
- 11.A.3. Receiving equipment for Global Navigation Satellite Systems (GNSS; e.g. GPS, GLONASS or Galileo), having any of the following characteristics, and specially designed components therefor:
- a. Designed or modified for use in systems specified in 1.A.; or
 - b. Designed or modified for airborne applications and having any of the following:
 1. Capable of providing navigation information at speeds in excess of 600 m/s;
 2. Employing decryption, designed or modified for military or governmental services, to gain access to GNSS secure signal/data; or
 3. Being specially designed to employ anti-jam features (e.g. null steering antenna or electronically steerable antenna) to function in an environment of active or passive countermeasures.

Note:

11.A.3.b.2. and 11.A.3.b.3. do not control equipment designed for commercial, civil or 'Safety of Life' (e.g. data integrity, flight safety) GNSS services.

- 11.A.4. Electronic assemblies and components, designed or modified for use in the systems specified in 1.A. or 19.A. and specially designed for military use and operation at temperatures in excess of 125°C.

Notes:

1. Equipment specified in 11.A. includes the following:
 - a. Terrain contour mapping equipment;
 - b. Scene mapping and correlation (both digital and analogue) equipment;
 - c. Doppler navigation radar equipment;
 - d. Passive interferometer equipment;
 - e. Imaging sensor equipment (both active and passive).
2. Equipment specified in 11.A. may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

- 11.A.5. Umbilical and interstage electrical connectors specially designed for systems specified in 1.A.1. or 19.A.1.

Technical Note:

Interstage connectors referred to in 11.A.5. also include electrical connectors installed between systems specified in 1.A.1. or 19.A.1. and their "payload".

11.B. TEST AND PRODUCTION EQUIPMENT

None.

11.C. MATERIALS

None.

11.D. SOFTWARE

11.D.1. "Software" specially designed or modified for the "use" of equipment specified in 11.A.1., 11.A.2. or 11.A.4.

11.D.2. "Software" specially designed for the "use" of equipment specified in 11.A.3.

11.E. TECHNOLOGY

11.E.1. Design "technology" for protection of avionics and electrical subsystems against Electromagnetic Pulse (EMP) and Electromagnetic Interference (EMI) hazards from external sources, as follows:

- a. Design "technology" for shielding systems;
- b. Design "technology" for the configuration of hardened electrical circuits and subsystems;
- c. Design "technology" for determination of hardening criteria for the above.

11.E.2. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 11.A. or 11.D.

CATEGORY II, ITEM 12**ITEM 12 LAUNCH SUPPORT****12.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

12.A.1. Apparatus and devices, designed or modified for the handling, control, activation and launching of the systems specified in 1.A., 19.A.1., or 19.A.2.

12.A.2. Vehicles designed or modified for the transport, handling, control, activation and launching of the systems specified in 1.A.

12.A.3. **[Gravity meters (gravimeters), gravity gradiometers, and specially designed components therefore, designed or modified for airborne or marine use, and having a static or operational accuracy of $7 \times 10^{-6} \text{ m/s}^2$ (0.7 milligal) or better, with a time –steady state registration of two minutes or less, usable for systems specified in 1.A.] Gravity meters (gravimeters) or gravity gradiometers, designed or modified for airborne or marine use, usable for systems specified in 1.A., as follows, and specially designed components therefor:**

a. Gravity meters having all the following:

1. A static or operational accuracy equal to or less (better) than 0.7 milligal (mgal); and
2. A time to steady-state registration of two minutes or less;

b. Gravity gradiometers.

12.A.4. Telemetry and telecontrol equipment, including ground equipment, designed or modified for systems specified in 1.A., 19.A.1. or 19.A.2.

Notes:

- 1. 12.A.4. does not control equipment designed or modified for manned aircraft or satellites.*
- 2. 12.A.4. does not control ground based equipment designed or modified for terrestrial or marine applications.*

3. 12.A.4. *does not control equipment designed for commercial, civil or 'Safety of Life' (e.g. data integrity, flight safety) GNSS services.*

12.A.5. Precision tracking systems, usable for systems specified in 1.A., 19.A.1. or 19.A.2. as follows:

a. Tracking systems which use a code translator installed on the rocket or unmanned aerial vehicle in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of inflight position and velocity;

b. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:

1. Angular resolution better than 1.5 mrad;
2. Range of 30 km or greater with a range resolution better than 10 m rms; and
3. Velocity resolution better than 3 m/s.

12.A.6. Thermal batteries designed or modified for the systems specified in 1.A., 19.A.1. or 19.A.2.

Note:

Item 12.A.6. does not control thermal batteries specially designed for rocket systems or unmanned aerial vehicles that are not capable of a "range" equal to or greater than 300 km.

Technical Note:

Thermal batteries are single use batteries that contain a solid non-conducting inorganic salt as the electrolyte. These batteries incorporate a pyrolytic material that, when ignited, melts the electrolyte and activates the battery.

[Note:

Item 12.A.6. does not control thermal batteries specially designed for rocket systems or unmanned aerial vehicles that are not capable of a "range" equal to or greater than 300 km.]

12.B. TEST AND PRODUCTION EQUIPMENT

None.

12.C. MATERIALS

None.

12.D. SOFTWARE

12.D.1. "Software" specially designed or modified for the "use" of equipment specified in 12.A.1.

12.D.2. "Software" which processes post-flight, recorded data, enabling determination of vehicle position throughout its flight path, specially designed or modified for systems specified in 1.A., 19.A.1. or 19.A.2.

12.D.3. "Software" specially designed or modified for the "use" of equipment specified in 12.A.4. or 12.A.5., usable for systems specified in 1.A., 19.A.1. or 19.A.2.

12.E. TECHNOLOGY

12.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 12.A. or 12.D.

CATEGORY II, ITEM 13**ITEM 13 COMPUTERS****13.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

13.A.1. Analogue computers, digital computers or digital differential analysers, designed or modified for use in the systems specified in 1.A., having any of the following characteristics:

a. Rated for continuous operation at temperatures from below -45°C to above $+55^{\circ}\text{C}$; or

b. Designed as ruggedised or "radiation hardened".

13.B. TEST AND PRODUCTION EQUIPMENT

None.

13.C. MATERIALS

None.

13.D. SOFTWARE

None.

13.E. TECHNOLOGY

13.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment specified in 13.A.

Note:

Item 13 equipment may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

CATEGORY II, ITEM 14**ITEM 14 ANALOGUE TO DIGITAL CONVERTERS****14.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

14.A.1. Analogue-to-digital converters, usable in the systems specified in 1.A., having any of the following characteristics:

- a. Designed to meet military specifications for ruggedised equipment; or
- b. Designed or modified for military use and being any of the following types:
 1. Analogue-to-digital converter "microcircuits", which are "radiation-hardened" or have all of the following characteristics:
 - a. Having a quantisation corresponding to 8 bits or more when coded in the binary system;
 - b. Rated for operation in the temperature range from below -54°C to above $+125^{\circ}\text{C}$; and
 - c. Hermetically sealed; or
 2. Electrical input type analogue-to-digital converter printed circuit boards or modules, having all of the following characteristics:
 - a. Having a quantisation corresponding to 8 bits or more when coded in the binary system;
 - b. Rated for operation in the temperature range from below -45°C to above $+55^{\circ}\text{C}$; and
 - c. Incorporating "microcircuits" specified in 14.A.1.b.1.

14.B. TEST AND PRODUCTION EQUIPMENT

None.

14.C. MATERIALS

None.

14.D. SOFTWARE

None.

14.E. TECHNOLOGY

14.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment specified in 14.A.

CATEGORY II, ITEM 15**ITEM 15 TEST FACILITIES AND EQUIPMENT****15.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

None.

15.B. TEST AND PRODUCTION EQUIPMENT

15.B.1. Vibration test equipment, usable for the systems specified in 1.A., 19.A.1. or 19.A.2. or the subsystems specified in 2.A. or 20.A., and components therefor, as follows:

- a. Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller, capable of vibrating a system at an acceleration equal to or greater than 10 g rms between 20 Hz and 2 kHz while imparting forces equal to or greater than 50 kN, measured 'bare table';
- b. Digital controllers, combined with specially designed vibration test "software", with a 'real-time control bandwidth' greater than 5 kHz and designed for use with vibration test systems specified in 15.B.1.a.;

Technical Note:

'Real-time control bandwidth' is defined as the maximum rate at which a controller can execute complete cycles of sampling, processing data and transmitting control signals.

- c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force equal to or greater than 50 kN, measured 'bare table', and usable in vibration test systems specified in 15.B.1.a.;
- d. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing

an effective combined force equal to or greater than 50 kN, measured 'bare table', and usable in vibration test systems specified in 15.B.1.a.

Technical Note:

Vibration test systems incorporating a digital controller are those systems, the functions of which are, partly or entirely, automatically controlled by stored and digitally coded electrical signals.

- 15.B.2. **[Wind tunnels]** 'Aerodynamic test facilities' for speeds of Mach 0.9 or more, usable for the systems specified in 1.A. or 19.A. or the subsystems specified in 2.A. or 20.A.

Note:

Item 15.B.2 does not control wind-tunnels for speeds of Mach 3 or less with dimension of the 'test cross section size' equal to or less than 250 mm.

Technical Notes:

1. 'Aerodynamic test facilities' includes wind tunnels and shock tunnels for the study of airflow over objects.

2. 'Test cross section size' means the diameter of the circle, or the side of the square, or the longest side of the rectangle, or the major axis of the ellipse at the largest 'test cross section' location. 'Test cross section' is the section perpendicular to the flow direction.

- 15.B.3. Test benches/stands, usable for the systems specified in 1.A., 19.A.1. or 19.A.2. or the subsystems specified in 2.A. or 20.A., which have the capacity to handle solid or liquid propellant rockets, motors or engines having a thrust greater than 68 kN, or which are capable of simultaneously measuring the three axial thrust components.

- 15.B.4. Environmental chambers as follows, usable for the systems specified in 1.A. or 19.A. or the subsystems specified in 2.A. or 20.A.:

a. Environmental chambers capable of simulating all the following flight conditions:

1. Having any of the following:

- a. Altitude equal to or greater than 15 km; or
 - b. Temperature range from below -50°C to above 125°C ; and
2. Incorporating, or designed or modified to incorporate, a shaker unit or other vibration test equipment to produce vibration environments equal to or greater than 10 g rms, measured 'bare table', between 20 Hz and 2 kHz while imparting forces equal to or greater than 5 kN;

Technical Notes:

1. *Item 15.B.4.a.2. describes systems that are capable of generating a vibration environment with a single wave (e.g. a sine wave) and systems capable of generating a broad band random vibration (i.e. power spectrum).*

2. *In Item 15.B.4.a.2., designed or modified means the environmental chamber provides appropriate interfaces (e.g. sealing devices) to incorporate a shaker unit or other vibration test equipment as specified in this Item.*

- b. Environmental chambers capable of simulating all of the following flight conditions:
 1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to $2 \times 10^{-5} \text{ N/m}^2$) or with a total rated acoustic power output of 4 kW or greater; and
 2. Any of the following:
 - a. Altitude equal to or greater than 15 km; or
 - b. Temperature range from below -50°C to above 125°C .

15.B.5. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated electrons of 2 MeV or greater, and equipment containing those accelerators, usable for the systems specified in 1.A., 19.A.1. or 19.A.2. or the subsystems specified in 2.A. or 20.A.

Note:

15.B.5. does not control equipment specially designed for medical purposes.

Technical Note:

In Item 15.B. 'bare table' means a flat table, or surface, with no fixture or fittings.

15.C. MATERIALS

None.

15.D. SOFTWARE

15.D.1. "Software" specially designed or modified for the "use" of equipment specified in 15.B. usable for testing systems specified in 1.A., 19.A.1. or 19.A.2. or subsystems specified in 2.A. or 20.A.

15.E. TECHNOLOGY

15.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 15.B. or 15.D.

CATEGORY II, ITEM 16**ITEM 16 MODELLING-SIMULATION AND DESIGN INTEGRATION****16.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 16.A.1. Specially designed hybrid (combined analogue/digital) computers for modelling, simulation or design integration of systems specified in 1.A. or the subsystems specified in 2.A.

Note:

This control only applies when the equipment is supplied with "software" specified in 16.D.1.

16.B. TEST AND PRODUCTION EQUIPMENT

None.

16.C. MATERIALS

None.

16.D. SOFTWARE

- 16.D.1. "Software" specially designed for modelling, simulation, or design integration of the systems specified in 1.A. or the subsystems specified in 2.A or 20.A.

Technical Note:

The modelling includes in particular the aerodynamic and thermodynamic analysis of the systems.

16.E. TECHNOLOGY

- 16.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 16.A. or 16.D.

CATEGORY II, ITEM 17**ITEM 17 STEALTH****17.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

17.A.1. Devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures (i.e. stealth technology), for applications usable for the systems specified in 1.A. or 19.A. or the subsystems specified in 2.A. or 20.A.

17.B. TEST AND PRODUCTION EQUIPMENT

17.B.1. Systems, specially designed for radar cross section measurement, usable for the systems specified in 1.A., 19.A.1. or 19.A.2. or the subsystems specified in 2.A.

17.C. MATERIALS

17.C.1. Materials for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures (i.e. stealth technology), for applications usable for the systems specified in 1.A. or 19.A. or the subsystems specified in 2.A.

Notes:

1. 17.C.1. includes structural materials and coatings (including paints), specially designed for reduced or tailored reflectivity or emissivity in the microwave, infrared or ultraviolet spectra.
2. 17.C.1. does not control coatings (including paints) when specially used for thermal control of satellites.

17.D. SOFTWARE

17.D.1. "Software" specially designed for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures (i.e. stealth

technology), for applications usable for the systems specified in 1.A. or 19.A. or the subsystems specified in 2.A.

Note:

17.D.1. includes "software" specially designed for analysis of signature reduction.

17.E. TECHNOLOGY

17.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment, materials or "software" specified in 17.A., 17.B., 17.C. or 17.D.

Note:

17.E.1. includes databases specially designed for analysis of signature reduction.

CATEGORY II, ITEM 18**ITEM 18 NUCLEAR EFFECTS PROTECTION****18.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 18.A.1. "Radiation Hardened" "microcircuits" usable in protecting rocket systems and unmanned aerial vehicles against nuclear effects (e.g. Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems specified in 1.A.
- 18.A.2. 'Detectors' specially designed or modified to protect rocket systems and unmanned aerial vehicles against nuclear effects (e.g. Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems specified in 1.A.

Technical Note:

A 'detector' is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material. This includes devices that sense by one time operation or failure.

- 18.A.3. Radomes designed to withstand a combined thermal shock greater than $4.184 \times 10^6 \text{ J/m}^2$ accompanied by a peak over pressure of greater than 50 kPa, usable in protecting rocket systems and unmanned aerial vehicles against nuclear effects (e.g. Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems specified in 1.A.

18.B. TEST AND PRODUCTION EQUIPMENT

None.

18.C. MATERIALS

None.

18.D. SOFTWARE

None.

18.E. TECHNOLOGY

18.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment specified in 18.A.

CATEGORY II, ITEM 19**ITEM 19 OTHER COMPLETE DELIVERY SYSTEMS****19.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS**

- 19.A.1. Complete rocket systems (including ballistic missile systems, space launch vehicles, and sounding rockets), not specified in 1.A.1., capable of a "range" equal to or greater than 300 km.
- 19.A.2. Complete unmanned aerial vehicle systems (including cruise missile systems, target drones and reconnaissance drones), not specified in 1.A.2., capable of a "range" equal to or greater than 300 km.
- 19.A.3. Complete unmanned aerial vehicle systems, not specified in 1.A.2. or 19.A.2., having all of the following:
- a. Having any of the following:
 1. An autonomous flight control and navigation capability; or
 2. Capability of controlled flight out of the direct vision range involving a human operator; and
 - b. Having any of the following:
 1. Incorporating an aerosol dispensing system/mechanism with a capacity greater than 20 litres; or
 2. Designed or modified to incorporate an aerosol dispensing system/mechanism with a capacity greater than 20 litres.

Note:

Item 19.A.3. does not control model aircraft, specially designed for recreational or competition purposes.

Technical Notes:

1. *An aerosol consists of particulate or liquids other than fuel components, by-products or additives, as part of the "payload" to be dispersed in the atmosphere. Examples of aerosols include pesticides for crop dusting and dry chemicals for cloud seeding.*

2. *An aerosol dispensing system/mechanism contains all those devices (mechanical, electrical, hydraulic, etc.), which are necessary for storage and dispersion of an aerosol into the atmosphere. This includes the possibility of aerosol injection into the combustion exhaust vapour and into the propeller slip stream.*

[Note:

Item 19.A.3. does not control model aircraft, specially designed for recreational or competition purposes.]

19.B. TEST AND PRODUCTION EQUIPMENT

- 19.B.1. "Production facilities" specially designed for the systems specified in 19.A.1 or 19.A.2.

19.C. MATERIALS

None.

19.D. SOFTWARE

- 19.D.1. "Software" which coordinates the function of more than one subsystem, specially designed or modified for "use" in the systems specified in 19.A.1. or 19.A.2.

19.E. TECHNOLOGY

- 19.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment specified in 19.A. 1. or 19.A.2.

CATEGORY II, ITEM 20**ITEM 20 OTHER COMPLETE SUBSYSTEMS****20.A. EQUIPMENT, ASSEMBLIES AND COMPONENTS****20.A.1. Complete subsystems as follows:**

- a. Individual rocket stages, not specified in 2.A.1., usable in systems specified in 19.A.;
- b. **[Solid propellant rocket motors or liquid propellant rocket engines, not specified in 2.A.1, usable in systems specified in 19.A, having a total impulse capacity equal to or greater than 8.41×10^5 Ns, but less than 1.1×10^6 Ns.] Rocket propulsion subsystems, not specified in 2.A.1., usable in the systems specified in 19.A.1., as follows:
 1. Solid propellant rocket motors or hybrid rocket motors having a total impulse capacity equal to or greater than 8.41×10^5 Ns, but less than 1.1×10^6 Ns;
 2. Liquid propellant rocket engines integrated, or designed or modified to be integrated, into a liquid propellant propulsion system which has a total impulse capacity equal to or greater than 8.41×10^5 Ns, but less than 1.1×10^6 Ns;**

20.B. TEST AND PRODUCTION EQUIPMENT

20.B.1. "Production facilities" specially designed for the subsystems specified in 20.A.

20.B.2. "Production equipment" specially designed for the subsystems specified in 20.A.

20.C. MATERIALS

None.

20.D. SOFTWARE

20.D.1. "Software" specially designed or modified for the systems specified in 20.B.1.

20.D.2. "Software", not specified in 2.D.2., specially designed or modified for the "use" of rocket motors or engines specified in 20.A.1.b.

20.E. TECHNOLOGY

20.E.1. "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 20.A., 20.B. or 20.D.

UNITS, CONSTANTS, ACRONYMS AND ABBREVIATIONS USED IN THIS ANNEX

ABEC	Annular Bearing Engineers Committee
ABMA	American Bearing Manufactures Association
ANSI	American National Standards Institute
Angstrom	1×10^{-10} metre
ASTM	American Society for Testing and Materials
bar	unit of pressure
°C	degree Celsius
cc	cubic centimetre
CAS	Chemical Abstracts Service
CEP	Circle of Equal Probability
dB	decibel
g	gram; also, acceleration due to gravity
GHz	gigahertz
GNSS	Global Navigation Satellite System e.g. 'Galileo' 'GLONASS' - Global'naya Navigatsionnaya Sputnikovaya Sistema 'GPS' – Global Positioning System
h	hour
Hz	hertz
HTPB	Hydroxy–Terminated Polybutadiene
ICAO	International Civil Aviation Organisation
IEEE	Institute of Electrical and Electronic Engineers

IR	Infrared
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industrial Standard
K	Kelvin
kg	kilogram
kHz	kilohertz
km	kilometre
kN	kilonewton
kPa	kilopascal
kW	kilowatt
m	metre
MeV	million electron volt or mega electron volt
MHz	megahertz
milligal	10^{-5} m/s^2 (also called mGal, mgal or milligalileo)
mm	millimetre
mm Hg	mm of mercury
MPa	megapascal
mrad	milliradian
ms	millisecond
μm	micrometre
N	newton
Pa	pascal
ppm	parts per million
rads (Si)	radiation absorbed dose
RF	radio frequency
rms	root mean square
rpm	revolutions per minute
RV	Re-entry Vehicles
s	second
Tg	glass transition temperature
Tyler	Tyler mesh size, or Tyler standard sieve series
UAV	Unmanned Aerial Vehicle
UV	Ultra violet

<u>TABLE OF CONVERSIONS USED IN THIS ANNEX</u>		
Unit (from)	Unit (to)	Conversion
bar	pascal (Pa)	1 bar = 100 kPa
g (gravity)	m/s ²	1 g = 9.806 65 m/s ²
mrad (millirad)	degrees (angle)	1 mrad ≈ 0.0573°
rads	ergs/gram of Si	1 rad (Si) = 100 ergs/gram of silicon (= 0.01 gray [Gy])
Tyler 250 mesh	mm.	for a Tyler 250 mesh, mesh opening 0.063 mm

[END QUOTE] END

IMPORTANT Reminder from Government Printing Works

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