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Regulatory Policy Division
Bureau of Industry and Security
U.S. Department of Commerce
Washington, DC

RE: RIN 0694-AF53

In response to the May 2, 2012 proposed rule (RIN 0694-AF53) concerning Revisions to the Export Administration Regulations (EAR): Controls of Energetic Materials and Related Articles That the President Determines No Longer Warrant Control Under the United States Munitions List (USML), Air Products and Chemicals, Inc. (Air Products) respectfully submits this comment on the proposed changes to the classification of chlorine trifluoride (ClF3), which is currently licensed by the Department of Commerce, Bureau of Industry and Security ("BIS") under ECCN 1C238 on the Commerce Control List ("CCL").

Air Products, headquartered in Allentown, Pennsylvania, is a global company serving customers in the technology, energy, agricultural, and industrial markets worldwide with a unique portfolio of products, services and solutions. Air Products has built leading positions in key growth markets such as semiconductor materials, refinery hydrogen, natural gas liquefaction, epoxy additives, advanced coatings, and adhesives. A Fortune 500 company and U.S.-based manufacturer and exporter with annual revenues exceeding $10 billion, Air Products employs 18,000 people in the United States.

As a leading supplier of ClF3 to the semiconductor industry, and the only U.S.-based supplier of ClF3, Air Products is concerned that the proposed rule will impose controls on Air Products' ClF3 product that are not warranted, and that will have an

adverse effect on Air Products' global market position in sales of this important product. As the primary market for ClF3 are semiconductor manufacturers in Asia (specifically South Korea, Singapore, Taiwan, and China) and Air Products' primary competitors, Central Glass and Kanto Denka, are located in Japan, the imposition of overly restrictive, unilateral U.S. controls on ClF3 could make it extremely difficult for Air Products to remain competitive in this market space.

BIS's Proposed Changes to the Controls on ClF3

BIS has for years licensed Air Products' commercial exports of ClF3 exclusively under ECCN 1C238 ("[c]hlorine trifluoride"), which is subject to controls only for nuclear non-proliferation (NP) and anti-terrorism (AT) reasons. The proposed rule also notes the potential relevance of aspects of ECCN 1C018.m ("[a]ny oxidizer or mixture thereof that is a compound composed of fluorine and one or more of the following—other halogens, oxygen, or nitrogen.") Under the proposed rule, BIS would control ClF3 exclusively under 1C111.a.3.f. This change would make all forms of ClF3, even those purified and packaged in commercial quantities for civil applications, and related technology, subject to restrictive Missile Technology (MT) reasons for control.

Background on ClF3

Although ClF3 has a number of potential uses, its primary industrial application is in chemical vapor deposition (CVD) and diffusion furnace processes for nonplasma cleans. These processes are essential to the manufacture semiconductors. Most major manufacturers of CVD furnaces have tools modified to use ClF3 as the chamber clean and one, Tokyo Electron (TEL), has a full line of tools designed exclusively for use with ClF3. Most of the semiconductor foundries that employ these tools are located in Asia and these companies are the primary end users of ClF3.

Due to the requirements of the semiconductor industry, ClF3 for use in the semiconductor production process is manufactured as a high-purity liquefied gas and packaged in specially prepared compressed gas, steel cylinders. Preparation of these packages includes a proprietary Electronic cylinder preparation process to insure an ultra-smooth and contaminant free inner surface and the installation of a high purity stainless steel valve. Additionally, the cylinder and valve must be passivated to avoid potential failure of the cylinder due to the extreme reactivity of ClF3 (detailed below). The maximum commercial quantity of ClF3 in our largest

cylinder size is 130 lbs, although the average cylinder quantity is much lower due to on-site restrictions of our customers based on the product's toxicity and reactivity. The quantities in which we sell ClF3 are significantly smaller than quantities necessary for missile applications. ClF3 is used after the chemical vapor deposition process; residue deposited on the surfaces of the process chamber must be removed to prevent particle contamination and process drift. CVD Chambers are cleaned using an etch process that reacts and volatilizes the CVD residue. ClF3 is often preferred for use over other chemicals because it can be used to remove semiconductor material from the chamber walls without having to dismantle the chamber. Also, unlike most of the alternative chemicals used in this role, it does not need to be activated by the use of plasma since the heat of the chamber is enough to initiate a reaction between the ClF3 and the residual semiconductor materials inside the chamber.

While Air Products produces ClF3 *solely* for semiconductor manufacturing, ClF3 does have other potential end uses. It can be used as a material in nuclear reactor fuel reprocessing, and accordingly has been subject to NP controls under ECCN 1C238 since 1995 (and counterpart entries in the pre-1995 CCL).

In addition, ClF3 has, in the past, been investigated for use as a high-performance storable oxidizer in rocket propellant systems. Indeed, there are indications that in the 1950s certain parties analyzed ClF3's suitability for such purposes. Although testing reportedly showed that ClF3 provided moderately high performance as a high-density storable oxidizer in propellant systems, the investigators discovered several serious drawbacks to its use.

First, ClF3 is hypergolic (*i.e.*, it will ignite spontaneously on contact) and will react violently with most all other substances, including the materials of construction of the wetted surfaces. Accordingly, the handling, storage and use of ClF3 require materials of construction that can be cleaned and passivated to form non-volatile fluoride coatings that will resist further reaction. Therefore, the choice of materials and proper passivation procedures are essential to prevent catastrophic component failure. Moreover, in addition to proper cleaning and passivation, special handling precautions must be used to prevent potential failure of the materials of construction used to handle and store the ClF3.

Another drawback to use is the products that result from the combustion of ClF3 are highly toxic and extremely corrosive. ClF3 is also a very poor conductor of heat so the regenerative cooling capacity of the propellant is limited. This leads to overheating, accelerated corrosion, and eventual failure of uncooled propellant systems.

For these reasons, and because of several major industrial accidents it was determined that handling problems and safety concerns far outweighed the performance benefits and research into ClF3 as a missile or rocket propellant was abandoned in the 1970s.

Suggested Changes to the Proposed Rule

Air Products has a long history of obtaining export licensing for ClF3 from BIS, with interagency concurrence, exclusively under ECCN 1C238, and the company received a license from BIS for the export of ClF3 under 1C238 as recently as June 9, 2012. Air Products is not opposed to the transfer of ClF3 to ECCN 1C111.a.3.f. However, we feel that that the "Reasons for Control" section of the ECCN should be modified to reflect the fact that certain forms of ClF3 when purified and packaged in commercial quantities for civil applications should not be subject to MT controls. In particular, we believe that the following minor adjustments should be made to the Reason for Control section in the version of 1C111 in the proposed rule, followed by a note to a.3.f, as follows:

1C111 Propellants and constituent chemicals for propellants, other than those specified in 1C011, as follows (see List of Items Controlled).

License Requirements

Reason for Control: MT, NP, AT

As Proposed by BIS	As Suggested by Air Products
MT applies to entire entry MT Column 1	MT applies to entire entry, MT Column 1 **except as noted in 1C111.a.3.f**
NP applies to 1C111.a.3.f only NP Column 1	NP applies to 1C111.a.3.f only NP Column 1
AT applies to entire entry AT Column 1	AT applies to entire entry AT Column 1

1C111.a.3.f Chlorine trifluoride (ClF3).

Note: Chlorine trifluoride is not controlled for MT reasons when purified and packaged in commercial quantities for civil applications.

If this change is adopted by BIS, we ask that conforming changes also be made to the technology controls applicable to this entry.

Air Products is grateful for the opportunity to comment on the proposed rule and would greatly appreciate consideration of its comments and recommended adjustments to ECCN 1C111.a.3.f. As the only U.S. producer of ClF3, Air Products would be placed at a severe competitive disadvantage as compared to its non-U.S. competitors under the current proposed rule.

Sincerely,

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