

**TECHNICAL SUPPORT DOCUMENT FOR BULK  
IMPORTS AND EXPORTS OF FLUORINATED  
GHGS, N<sub>2</sub>O, AND CO<sub>2</sub>:**

**PROPOSED RULE FOR MANDATORY  
REPORTING OF GREENHOUSE GASES**

Office of Air and Radiation  
U.S. Environmental Protection Agency

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## 1. Source Description

Fluorinated greenhouse gases (fluorinated GHGs) are man-made gases used in several sectors, and include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>), nitrogen trifluoride (NF<sub>3</sub>), fluorinated ethers, and other compounds such as perfluoropolyethers. (Fluorinated GHGs also include chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), but since these ozone-depleting substances (ODSs) are currently being phased out and otherwise regulated under the Montreal Protocol and Title VI of the Clean Air Act, EPA is not proposing requirements for them under this rule.) Fluorinated GHGs are powerful greenhouse gases whose ability to trap heat in the atmosphere is often thousands to tens of thousands as great as that of CO<sub>2</sub>, on a pound-for-pound basis. Some fluorinated GHGs are also very long lived; SF<sub>6</sub> and the PFCs have lifetimes ranging from 3,200 to 50,000 years (IPCC 2006).

HFCs are the most common fluorinated GHGs, used primarily to replace ODSs in a number of applications, including air-conditioning and refrigeration, foams, solvents, and aerosols. PFCs are used in the fire fighting and in the semiconductor and other electronics sectors. SF<sub>6</sub> is used in a diverse array of applications, including electrical transmission and distribution equipment (as an electrical insulator and arc quencher) and in magnesium casting operations (as a cover gas to prevent oxidation of molten metal). NF<sub>3</sub> is used in the semiconductor industry, increasingly to reduce overall semiconductor greenhouse gas emissions through processes such as NF<sub>3</sub> remote cleaning and NF<sub>3</sub> substitution during in-situ cleaning. Fluorinated ethers (HFEs and HCFEs) are used as anesthetics (e.g., isoflurane, desflurane, and sevoflurane) and as heat transfer fluids (e.g., the H-Galdens). Fluorinated GHGs are also used as feedstocks to produce other chemicals.

Other non-fluorinated bulk GHGs are also imported into the United States. Specifically, nitrous oxide (N<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>) are imported into the country. N<sub>2</sub>O is primarily used as a carrier gas with oxygen to administer more potent inhalation anesthetics for general anesthesia, as well as a propellant in pressure and aerosol products. Bulk CO<sub>2</sub> gas is utilized by a wide variety of industries for operations such as welding, oil and gas recovery, fire extinguishing, and chemical production. CO<sub>2</sub> is also used in an array of consumer products, such as carbonated beverages and refrigerated appliances.

### a. Total Inventory

It is estimated that 110 million metric tons of CO<sub>2</sub> equivalent (MMTCO<sub>2</sub>e) of bulk HFC, PFC, NF<sub>3</sub>, SF<sub>6</sub>, N<sub>2</sub>O, and CO<sub>2</sub> gas were imported into the United States in 2006 (PIERS, 2007). More specifically, 2006 imports of HFCs are estimated to have exceeded 25 MMTCO<sub>2</sub>e, imports of PFCs are estimated to have exceeded 14 MMTCO<sub>2</sub>e, imports of SF<sub>6</sub> and NF<sub>3</sub> are estimated to have exceeded 35 MMTCO<sub>2</sub>e each, imports of N<sub>2</sub>O are estimated to almost reach 0.3 MMTCO<sub>2</sub>e, and imports of CO<sub>2</sub> are estimated to be almost 0.1 MMTCO<sub>2</sub>e. The breakdown of total bulk gas imports by gas is shown in Table 1. Although NF<sub>3</sub> and SF<sub>6</sub> account for less than 10 percent of imports on a metric ton basis, they account for over 60% of imports when weighted by global warming potential (GWP).

**Table 1. 2006 U.S. Bulk Gas Imports by Gas Type**

Bulk Gas Type	Amount Imported (mt)	Percent of mt Total	Amount Imported (mtCO <sub>2</sub> e)	Percent of mtCO <sub>2</sub> e Total
HFCs	32,245	82%	25,192,652	23%
PFCs	1,679	4%	14,024,068	13
NF <sub>3</sub>	2,035	5%	35,009,809	32
SF <sub>6</sub>	1,485	4%	35,502,625	32
N <sub>2</sub> O	957	2%	296,783	< 0.5
CO <sub>2</sub>	981	2%	981	< 0.5
All F-Gases	37,625	95%	109,729,154	100%
<b>All Gases</b>	<b>39,563</b>	<b>100%</b>	<b>110,026,918</b>	<b>100%</b>

Source: PIERS (2007)

It is estimated that there are 147 importers of bulk GHG gases into the United States (PIERS, 2007).

Several other gases with GWPs may also be imported, including fluorinated ethers, H-Galdens, and anesthetics such as desflurane (HFE-236ea2), isoflurane (HCFE-235da2), and sevoflurane (HFE-347mcc3). The imports of these gases have not currently been quantified.

## 2. Review of Existing Reporting Programs and Methodologies

Protocols and guidance reviewed for this analysis include the *2006 IPCC Guidelines*, Title VI of CAA, Part 75 Appendix D (measurement requirements for oil and natural gas), the Toxic Release Inventory (TRI), the Technical Guidelines for the Voluntary Reporting of Greenhouse Gases (1605(b) Program), the Toxic Substances Control Act (TSCA) Chemical Substance Inventory, EPA’s Climate Leaders Program, the Climate Registry, the European Commission’s Article 6 reporting, and the Australian Commonwealth Government Ozone Protection and Synthetic Greenhouse Gas Reporting Program.

Many existing programs require importers to provide the quantities imported and to keep more detailed records that permit verification of the reports. Title VI of the CAA includes detailed requirements for reporting and recordkeeping related to imports and exports of ozone-depleting substances; these requirements (with appropriate modifications) are being used as the model for the proposed rule. TSCA Inventory Update Reporting (IUR) requires importers to keep additional records beyond what is reported, which may be accessed by EPA at any time. Under the Ozone Protection and Synthetic Greenhouse Gas Management Act of 1989, Australia requires that importers of ODSs and fluorinated GHGs be certified prior to importing these gases and that they report all imports of these gases.

For the full review of existing programs, please refer to (EPA-HQ-OAR-2008-0508-054).

## 3. Options for Reporting Threshold

EPA evaluated a range of threshold options for bulk imports and exports. These included emission-based thresholds of 1,000, 10,000, 25,000, and 100,000 mtCO<sub>2</sub>e, summing imports across all gases. EPA also considered setting no threshold (requiring reporting of all imports), as is the case under Title VI of the Clean Air Act (CAA) and the Australian Synthetic Greenhouse Gas Reporting Program.

The results of this analysis are presented in Table 2. Virtually 100 percent of imports are covered by every threshold considered. However, the percentage of importers reporting varies markedly among thresholds, ranging from 30 percent at a threshold of 100,000 mtCO<sub>2</sub>e to 76 percent at a threshold of 1,000 mtCO<sub>2</sub>e. Forty-one percent of importers would be required to report at a threshold of 25,000 mtCO<sub>2</sub>e.

**Table 2. Threshold Analysis for Importers of Bulk Fluorinated GHGs and N<sub>2</sub>O**

Threshold Considered	Number of Importers Covered (% of Total)	Volume of Gas Covered in mtCO <sub>2</sub> e (% of Total)
1,000	111 (76%)	110,025,045 (100%)
10,000	81 (55%)	109,922,020 (100%)
25,000	61 (41%)	109,580,102 (100%)
100,000	44 (30%)	108,703,147 (99%)

Source: PIERS (2007)

When imports of CO<sub>2</sub> are also considered, the number of importers covered at the 1,000-mtCO<sub>2</sub>e threshold increases by one, to 112. There are no changes at higher thresholds.

Information about importers and quantities imported were obtained from PIERS (2007). The PIERS database uses “N/A” to indicate an imported shipment for which no importer was identified. The above analysis assumes that importers that were identified as “N/A” are one single entity. An additional sensitivity analysis that assumes that “N/A” importers are all separate entities was also performed. A total of 494 importers were identified under this analysis. Of this amount, 221 (45%) would be required to report under a 25,000 mtCO<sub>2</sub>e threshold, capturing 99% of bulk gas imports. The nearly equal results of the main threshold analysis and the additional sensitivity analysis indicate that the results of the main threshold analysis are robust with regard to unidentifiable importers.

Because it may be relatively easy for importers and exporters to create new corporations in order to divide up their imports and exports and remain below applicable thresholds, EPA considered setting no threshold for importers and exporters. The drawback of this approach is that it could substantially increase the burden of the rule, especially upon small businesses, without necessarily substantially increasing the quantity of imports or exports reported.

EPA also considered a range of publications from which to draw the 100-year GWPs that importers would use to determine whether their CO<sub>2</sub>-equivalent imports exceeded the applicable threshold. These included the IPCC Second Assessment Report (SAR) and later IPCC and other reports (e.g., the 2006 Scientific Assessment of Ozone Depletion published by the World Meteorological Organization.) The advantage of using the GWPs published in the SAR is that these are the GWPs that are used for current U.S. and international reporting of CO<sub>2</sub>-equivalent GHG emissions. The disadvantage is that the SAR does not list GWPs for some of the fluorinated GHGs that are coming into increasing use (notably NF<sub>3</sub> and many of the fluorinated ethers). However, if SAR GWPs were not available, importers could use the most recent GWP from either an IPCC Assessment Report or a WMO Scientific Assessment of Ozone Depletion.

#### **4. Options for Monitoring Methods**

The quantities of GHGs imported could be reported by chemical in tons or in mtCO<sub>2</sub>e. Reporting in tons of chemical would provide more transparency and reduce mistakes such as arithmetic errors or the use of inappropriate GWPs. In addition, tons of chemical is the unit in which other quantities (production, emissions, etc.) are proposed to be reported under this rule. Reports could include quantities imported in mixtures, and the name/number of the mixture, if applicable (e.g., HFC-410A).

Currently, net weight of chemical in bulk containers is declared using U.S. Customs and Border Protection CBP Form 7501: Entry Summary. This form requires reporting of gross shipment weight as well as “manifest quantity,” using Harmonized Tariff Schedule numbers and associated units of measure; the units of measure associated with chemical goods is kilograms, net of container weight. This applies for importers as well as the Census’ “Schedule B” for exports.

#### **5. Procedures for Estimating Missing Data**

No data should be missing as the data are required for importing and exporting in the United States.

#### **6. QA/QC Requirements**

QA/QC requirements could include reviewing the annual submission against the import and export transaction records to ensure that the information submitted to EPA is being accurately transcribed as the correct chemical or blend in the correct units and quantities (metric tons).

#### **7. Reporting Procedures**

Reporting of the following data would be useful for confirming and documenting import estimates:

- The quantity of GHGs imported by chemical in tons of chemical;
- The date on which the GHGs were imported;
- The port of entry through which the GHGs passed;
- The country from which the imported GHGs were imported; and
- The importer number for the shipment.

The following records would be useful for confirming and documenting import estimates:

- A copy of the bill of lading for the import;
- The invoice for the import;
- The U.S. Customs entry form;
- If applicable, dated records documenting the sale or transfer of the imported GHG for transformation or destruction; and,
- Persons who import heels of GHGs could be required to label their bill of lading or invoice indicating that the GHG in the container is a heel; and, in a manner as defined for ozone depleting substances in 40 CFR section 82.13, to report the amount brought into the United States and certify that the residual amount in each shipment is less than 10 percent of the volume of the container and will:
  - Remain in the container and be included in a future shipment;
  - Be recovered and transformed; or,
  - Be recovered and destroyed.

Reporting of the following data would be useful for confirming and documenting export estimates:

- The names and addresses of the exporter and the recipient of the exports;
- The exporter's Employee Identification Number;
- The quantity exported by chemical in tons of chemical;
- The date on which, and the port from which, the GHGs were exported from the United States or its territories; and
- The country to which the GHGs were exported.

The following records would be useful for confirming and documenting export estimates:

- A copy of the bill of lading for the export; and
- The invoice for the export.

Because heels (residual quantities inside returned containers) and transshipments (GHGs that originate in a foreign country and that are destined for another foreign country) would not be released in the United States, it may be appropriate to exclude them from reporting. However, it would be reasonable to require importers and exporters to keep records documenting the nature of these transactions. For example, parties who transship a GHG could be required to maintain records that indicated that the GHG originated in a foreign country and was destined for another foreign country and did not enter into commerce in the United States.

These reporting and recordkeeping requirements would be consistent with those of the Stratospheric Ozone Protection Program.

## 8. Definitions

Definitions from 40 CFR Part 82, Subpart A

**Heel** means the amount of a controlled substance that remains in a container after it is discharged or off-loaded (that is no more than ten percent of the volume of the container) and that the person owning or operating the container certifies the residual amount will remain in the container and be included in a future shipment, or be recovered for transformation, destruction or a non-emissive purpose.

**Import** means to land on, bring into, or introduce into, or attempt to land on, bring into, or introduce into any place subject to the jurisdiction of the United States whether or not such landing, bringing, or introduction constitutes an importation within the meaning of the customs laws of the United States, with the following exemptions:

- (1) Off-loading used or excess controlled substances or controlled products from a ship during servicing,
- (2) Bringing controlled substances into the U.S. from Mexico where the controlled substance had been admitted into Mexico in bond and was of U.S. origin, and
- (3) Bringing a controlled product into the U.S. when transported in a consignment of personal or household effects or in a similar non-commercial situation normally exempted from U.S. Customs attention.

**Transshipment** means the continuous shipment of a controlled substance, from a foreign state of origin through the United States or its territories, to a second foreign state of final destination, as long as the shipment does not enter into United States jurisdiction. A transshipment, as it moves through the United States or its territories, cannot be re-packaged, sorted, or otherwise changed in condition.

## 9. References

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