U.S. SUBMISSION
ISSUES RELATING TO HFCs, PFCs, AND SF_6

INTRODUCTION

The U.S. was one of the first nations to develop and implement a national strategy to control non-carbon dioxide (CO_2) gases, including the high global warming potential (GWP) gases. Since our 1999 submission under decision 17/CP.5, the United States has continued to implement aggressively policies and measures to reduce emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). The U.S. recognizes the nexus of ozone depletion and climate change and these efforts are intended to facilitate a smooth transition out of ozone depleting substances without creating new environmental issues. Our domestic programs emphasize emissions and overall climate impact rather than specific chemical use.

The United States continues to use a mix of regulatory and voluntary measures to promote responsible use including recovery and recycling, identification of alternative substances and technologies, avoiding technically unnecessary use, and catalyzing innovation and adoption of new, low- or no-emitting technologies. We have also worked to advance high-energy efficiency standards and the use of Life Cycle Climate Performance (LCCP) to ensure that opportunities for overall climate protection are not lost. In some applications, HFCs are the preferred alternative to ozone depleting substances, where they provide superior overall technical and environmental performance and safety.

Highlights of further ways and means of limiting HFC, PFC and SF_6 emissions implemented by the United States include: aggressive enforcement of no venting and recycling regulations; promotion of responsible use and avoidance of unnecessary high GWP use, broadened emission reduction programs with industry and the military through voluntary partnerships, and global collaboration for information sharing with international industry and military organizations.

The 1999 U.S. submission provides detail on programs launched in the 1990s to reduce high GWP emissions. The following updates U.S. progress and outlines new programs that limit emissions of high GWP gases.

REGULATORY ACTIONS

In the United States recovery of ozone depleting substance (ODS) refrigerants as well as their HFC and PFC substitutes is required. It is illegal knowingly to vent any refrigerant into the atmosphere during the maintenance, service, repair, or disposal of refrigeration and air-conditioning equipment. The United States enforces the no venting laws through the U.S. Environmental Protection Agency (EPA). Aggressive enforcement is a hallmark of the U.S. recovery, recycling and no venting programs for refrigerants. For example,

EPA can impose financial fines on violators of up to US$27,500 per day per violation. During 1999 and 2000, EPA issued financial penalties as high as US$3.5 million to violators of the non-venting prohibitions.

The Significant New Alternatives Policy (SNAP) program continues to establish acceptable and unacceptable use conditions for climate friendly alternatives particularly in the insulation foam, solvent, and refrigeration sectors. Under the SNAP program, U.S. EPA places limits on use of ODSs when the Agency determines that other existing alternatives "reduce overall risk to human health and the environment". The review process takes into account health, medical, environmental and safety considerations, energy efficiency and associated emissions of CO_2, and technical and economic considerations. By limiting use of global warming gases in specific applications where safe alternatives are available, this program facilitates the implementation of the Montreal Protocol and helps avoid unnecessary use of HFCs, PFCs and SF_6. A prime example of the EPA's success at limiting new greenhouse gas emissions is the Agency's 1999 decision to ban self-chilling can technologies using HFC-134a and HFC-152a. It was determined that even a small market penetration of these cans could substantially increase U.S. emissions of greenhouse gases. The Agency's analysis showed that a 5% market penetration of an HFC-134a self-chilling can resulted in greenhouse gas emissions of 96 million metric tons of carbon equivalent (MMTCE). At 25% market penetration, emissions would be nearly 479 MMTCE. Because the analysis demonstrated that unacceptably high greenhouse gas emissions would result from the direct release of the cans' refrigerants to the atmosphere, EPA listed the use of HFC-134a and HFC-152a as refrigerants in self-chilling cans as unacceptable.

VOLUNTARY PARTNERSHIPS

The 1999 U.S. submission outlined voluntary programs to reduce high GWP emissions in the aluminum, magnesium, semiconductor, HCFC-22 production and electric power transmission and distribution sectors. These programs continue, having reduced emissions by 8 MMTCE in 2000 and are expected to achieve reductions greater than 35 MMTCE in 2010 as compared to business as usual without these programs. In addition to specific program activities directed toward emission reductions and technology evaluation, these partnerships have made major contributions toward GHG inventory and data quality methods. Experience gained through these partnerships and expertise provided by industry participants enabled the development of IPCC Good Practice Methods for many high GWP sectors that previously lacked standardized emission inventory methods.

Sector-specific accomplishments since 1999 include the following:

Aluminum Since the partnership was formed in 1996, it has had great success in characterizing emissions from smelter operations and reducing overall emissions. The partners met their 2000 emission reduction goal of reducing emissions by over 45% from 1990 levels. A study to enable companies to quantify the cost of an anode effect is being

undertaken to help companies analyze current emissions and develop better emission reduction strategies.

HFC-23 Emission Reduction Program The partners have reduced emissions of HFC-23 through process optimization and thermal destruction. Despite an estimated 35% increase in production since 1990, total emissions in 2000 were below 1990 levels – a reduction of 4.8 MMTCE compared to business-as-usual.

SF_6 Emission Reduction Partnership for the Magnesium Industry U.S. EPA's Partners have developed practical emissions inventory methods, tested an SF_6 capture/recycle device, and implemented successful emission reduction strategies. U.S. EPA is also collaborating with the International Magnesium Association (IMA) to identify and evaluate protective cover gas alternatives to SF_6 and SO_2. The study is expected to be complete by the end of 2002.

SF_6 Emission Reduction Partnership for Electric Power Systems: Through its voluntary SF_6 partnership, the US has been instrumental in generating better data on worldwide production and sales of SF_6. This information is being used by both scientists and policymakers better to understand the flow of SF_6 through the economy and environment. In 2000, U.S. EPA and the Australian Greenhouse Office sponsored an international conference titled, "SF_6 and the Environment: Emission Reduction Strategies". This conference brought together 185 attendees from 11 countries, representing the electric power, magnesium industries and national governments. The conference provided an excellent forum for industry leaders to share expertise on the latest policy, technological and scientific advances regarding SF_6 emission reductions. Conference proceedings can be found at: http://www.epa.gov/highgwp1/sf6/proceedings.html

PFC Emission Reduction Partnership for Semiconductor Industry: U.S. EPA estimates U.S. semiconductor voluntary efforts will reduce PFC emissions in 2010 by 14 MMTCE compared to a scenario of no voluntary action. Launched in 1996, the "U.S. EPA PFC Emission Reduction Partnership for the Semiconductor Industry" has catalyzed global action by semiconductor manufacturers to reduce emissions of PFCs. Members of the World Semiconductor Council (WSC) produce over 90 percent of the world's semiconductors and have identified PFC emission reduction as the industry's top environmental priority. Despite an historical industry growth rate of over 14% per year, WSC member companies have committed to reduce emissions of PFCs by 10% below their 1995 baseline by 2010.

Several new voluntary programs have been launched since 1999 and are outlined below:

Mobile Air Conditioning

As part of the effort under the Montreal Protocol for the Protection of the Ozone Layer, new vehicles worldwide have been redesigned to use HFC-134a refrigerants in air conditioning systems rather than CFC-12. The production of CFC-12 refrigerants for use in developed countries was halted in 1996 and will be phased out globally by 2006.

HFC-134a was the global choice because it has no ozone depleting potential, has six times less global warming potential than CFC-12, is non-flammable, has low toxicity, and has cooling capacity and energy efficiency that can be made comparable to CFC-12 through engineering.

The U.S. EPA, the Society of Automotive Engineers (SAE), and the Mobile Air Conditioning Society Worldwide (MACS) have organized a global voluntary partnership to promote improved air conditioning systems and service. The choice of measures to improve the environmental performance of vehicle air conditioning systems is complicated because 1) both refrigerant and fuel consumption must be considered over the life of the vehicle, 2) customers demand reliable and affordable equipment, and 3) new systems may require special safety systems and technician training.

The partnership includes government, academic, environmental, testing, and corporate partners. Members as of January 2002 are: SAE, U.S. EPA, MACS, Ecole des Mines de Paris, Environment Canada, Environment Directorate-General of the European Commission, International Organization for Standardization, Underwriters Laboratories, University of Braunschweig, University if Illinois, US Army, US National Renewable Energy Research Laboratory, World Resources Institute, Audi, Behr, Bergstrom, BMW, CalsonicKansei, DaimlerChrysler, Delphi Automotive Systems, Denso, Eaton, Freightliner, General Motors, Goodyear, Honda, Johnson Controls, Konvekta, Nissan, Neutronics, Parker-Hannifin, Sanden, Snap-On Diagnostics, Texas Instruments, Toyota, Uview Ultraviolet Systems, Valeo, Visteon Corporation, Volkswagen, and Volvo Car Corporation.

Partner consensus on the best methods of speeding progress toward the implementation of more energy-efficient mobile air conditioning systems is outlined in the partnership brochure available at: http://www.epa.gov/appdstar/information.html

Military

Climate protection and stratospheric ozone depletion are environmental security concerns. The U.S. Department of Defense (DoD) approach to climate protection is being modeled after its successful contribution to stratospheric ozone protection—including active collaboration, policy leadership, and technology forcing. U.S. EPA and the U.S. DoD are coordinating to identify military-specific uses of HFCs, PFCs and SF6 and to identify opportunities to integrate ozone and climate change strategies.

In February 2001, one hundred and sixty military officers, environmental authorities and technical experts from 33 countries participated in a four-day workshop on the military role in protecting the stratospheric ozone layer and global climate. The workshop was jointly organized by the United Nations Environment Programme (UNEP), the U.S.EPA, and the U.S. DoD and supported by military and environmental organizations from Australia, Canada, Germany, the United Kingdom, the European Union, and the United States. It was agreed that military organizations can play an important role in reducing greenhouse gas emissions and stimulating technical innovation.

Investments in military energy efficiency improvements are often cost-effective and can actually enhance defense and warfare capability. Efficient aircraft, ships, and vehicles can be deployed more rapidly and require less logistical support. Equipment using less energy is harder to detect because there is lower heat, noise, and emission signatures.

Military organizations worldwide have sponsored technology demonstrations, first commercialization, and large-scale installations of photo-voltaic systems, solar turbines, solar homes and buildings, lighting and insulation upgrades, co-generation, district heating and cooling, and electric and hybrid vehicles. There can be significant markets for energy-efficient technology for the same applications as civilian sectors (buildings, vehicles, communications, offices, schools, etc.) and for military unique applications of solar, fuel cell and hybrid technology. Furthermore, the military is at the cutting edge for hydrodynamic and aerodynamic innovation.

Information and proceedings from the conference are available on the UNEP website: http://www.uneptie.org/ozonaction/events/military/home.html

Responsible Use of HFCs

Adherence to responsible use principles can lead to reductions in HFC emissions below current projections. U.S. EPA and an U.S. Industry Non-governmental Organization (INGO), The Alliance for Responsible Atmospheric Policy, are collaborating to implement a worldwide voluntary partnership for responsible use for HFC-producing and HFC-using industries. The program is scheduled to be launched in Spring 2002 and is expected to include both industry and government partners. In addition to sector-specific principles, partners will commit to Responsible Use Principles as follows:

- Select HFCs for applications where they provide health, safety, environmental advantages, or unique societal benefits
- Minimize HFC emissions to the lowest practical level during chemical manufacturing, and during use and disposal of equipment using cost-effective technology
- Design and operate HFC-producing plants with the goal of achieving zero HFC emissions
- Engineer, operate and maintain HFC-using systems to minimize emissions and maximize energy efficiency
- Recover, recycle, reclaim and/or destroy used HFCs where technically and economically feasible
- Promote comprehensive technician training in HFC handling to assure compliance with regulations and stewardship practices
- Meet all appropriate regulatory standards governing HFC equipment installation and maintenance, HFC transport and storage, and, where applicable, exceed such standards with voluntary initiatives
- Accurately report HFC production and promote models that accurately estimate emissions

Voluntary Code of Practice for HFC and PFC Fire Protection Agents

The overriding concern of the fire protection industry is the reduction of risk to people and property from the threat of fire through the use of products and systems proven to be effective. Nonetheless, the U.S. fire protection industry supports the goal of eliminating non-fire emissions of fire protection agents, and is committed to continuing to contribute both to ozone layer and climate change protection. HFCs and PFCs have been commercialized as replacements for ozone-depleting substances including halons. The development of these chemicals for use in fire and explosion suppression applications has been instrumental in achieving the accelerated halon production phase-out mandated by the Montreal Protocol. Currently, emissions of these agents from modern, properly maintained equipment is estimated at less than 2% per year of the installed bank. In collaboration with U.S. EPA, the Fire Equipment Manufacturers Association (FEMA), Fire Suppression System Association (FSSA), Halon Alternatives Research Corporation (HARC), and the National Association of Fire Equipment Distributors (NAFED) have developed an emission reduction strategy and set of measures intending to minimize HFC and PFC emissions. These measures address the development and implementation of relevant regulations and standards, discharge testing, technician training, decommissioning, servicing and disposal, record-keeping and reporting, and communication and outreach.

LIFE CYCLE CLIMATE ANALYSIS

For technologies that have direct greenhouse gas (GHG) emissions and indirect energy emissions such as refrigeration applications, the U.S. encourages use of Life-Cycle Climate Performance (LCCP) rather than solely focusing on the direct emissions. Life-Cycle Climate Performance considers emissions that occur during chemical manufacture, in chemical and product transportation, while charging equipment, and during recovery and disposal. And, very importantly, this calculation must include emissions from the generation of electricity and account for any additional energy that may be necessary to assure safe operation. Selection of the investment with the best LCCP (thus the minimum total GHG emissions) is recommended. The safe use of hydrocarbons, ammonia, CO_2 and other potential non-fluorocarbon substances also depends on technology and training that eliminate uncontrolled emissions. Containment strategies are equally applicable to fluorocarbons and non-fluorocarbons and help manufacturers choose technology with the best Life Cycle Climate Performance.

GLOBAL COMMUNICATIONS AND COLLABORATION

The U.S. is actively working to share technical information internationally. Since 1999, U.S. EPA has sponsored regular international technology conferences such as the Earth Technologies Forum, the SF_6 and the Environment: Emission Reduction Strategies Conference, and a workshop, in collaboration with the U.S. DoD and a number of other governments and Non-governmental Organizations (NGOs), on “The Importance of Military Organisations in Stratospheric Ozone and Climate Protection”. As illustrated by

the Mobile Air Conditioning Partnership, U.S. voluntary partnerships also increasingly include international industry organizations, NGOs and other governments. And U.S. EPA currently collaborates with a number of international industry organizations such as the International Magnesium Association, the International Aluminium Association, the Global Greenhouse Emissions Estimation Consortium, and the World Semiconductor Council.

This global coordination has several advantages. It:

1. Involves more companies.
2. Creates a "critical mass" of global researchers who collaborate on work.
3. Directs available funds to new work while using completed work to guide program and policy actions.
4. Harmonizes analytical input and advice necessary for regulatory approaches to maintain global markets and reduce compliance costs.
5. Speeds commercialization and implementation of best practices and best technology.
6. Simplifies communication of technical progress by joint publication of consensus reports.

SUMMARY AND EXPECTED OUTCOMES

HFCs, PFCs and SF_6 are significant for climate change because they have high global warming potentials and some have long atmospheric lifetimes. Although these greenhouse gases now represent less than 2% of the U.S. annual greenhouse gas emissions, regulatory and voluntary actions are being taken to stabilize or reduce emissions. The United State is committed to making cost-effective national emission reduction choices that protect both the ozone layer and climate without compromising other environmental, health and safety concerns.

High GWP gas use is critical in certain industrial sectors. Careful management of these materials is an essential component of U.S. climate and stratospheric ozone protection goals. U.S. programs for HFCs, PFCs and SF_6 pursue technically feasible and cost-effective emission reductions within an international and national framework for industry action. This strategy allows for long-term planning and investment in reducing all greenhouse gas emissions.

In addition to regulatory programs that target unnecessary emissions, public-private industry partnerships are substantially reducing US emissions of HFCs, PFCs and SF_6. These partnerships are successfully developing cost-effective improvements in processes and products that emit greenhouse gases and helping to facilitate the development of high quality data on emissions. Working directly with industry accelerates relevant scientific and technological research, supports the development of innovative operating practices and technologies, and facilitates information sharing for customized implementation of emission reduction methods.