Description of document:	**Reports produced for Congress by the Environmental Protection Agency (EPA) which were not posted on the EPA public internet website, 2006 - 2007**
Requested date:	08-November-2009
Released date:	21-December-2009
Posted date:	11-January-2010
Title of document	See following page
Source of document:	United States Environmental Protection Agency Agency Freedom of Information Office (2822T) 1200 Pennsylvania Avenue NW Washington, DC 20460 Phone: (202) 566-1667 Fax: (202) 566-2147 E-mail: hq.foia@epa.gov

Reports Included in this Release

- 2004-05 Biennial Review of the Louisiana Coastal Wetlands Conservation Plan
- Implementation of the Waste Isolation Pilot Plant Land Withdrawal Act FY 2005 Report to Congress, April 2007
- Report to Congress: Stratospheric Ozone Protection - Title VI of the Clean Air Act Amendments of 1990
- Environmental Effects of Ozone Depletion and Its Interactions with Climate Change: 2006 Assessment
- Montreal Protocol on Substances that Deplete the Ozone Layer, 2006 Assessment Report of the
- Technology and Economic Assessment Panel
- U.S. Environmental Protection Agency Small Business Procurement Scorecard (SBPS), June 2007

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 2 1 2009

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

RE: Freedom of Information Act Request HQ-FOI-00285-10

This is in response to your Freedom of Information Act request dated November 8, 2009 requesting a copy of reports produced for Congress by the United States Environmental Protection Agency during the past three years and that are not posted on the EPA public internet website.

In accordance with subsequent e-mails from you to Deborah Johnson, FOIA Coordinator, you modified your request to formally-prepared and Administration-approved documents that were sent to the Hill and for our search for such documents to be narrowed to EPA's Office of Congressional and Intergovernmental Relations, Offices of Congressional Affairs and Information and Management Division.

Enclosed you will find copies of documents that are responsive to your modified request.

The Agency has granted your request in full however if you consider this response to be a denial you may appeal this response to the National Freedom of Information Officer, U.S. EPA, FOIA and Privacy Branch, 1200 Pennsylvania Avenue, N.W. (2822T), Washington, DC 20460 (U.S. Postal Service Only), FAX: (202) 566-2147, E-mail: hq.foia@epa.gov. Only items mailed through the United States Postal Service may be delivered to 1200 Pennsylvania Avenue, NW. If you are submitting your appeal via hand delivery, courier service or overnight delivery, you must address your correspondence to 1301 Constitution Avenue, N.W., Room 6416J, Washington, DC 20001. Your appeal must be made in writing, and it must be submitted no later than 30 calendar days from the date of this letter. The Agency will not consider appeals received after the 30 calendar day limit. The appeal letter should include the RIN listed above. For quickest possible handling, the appeal letter and its envelope should be marked "Freedom of Information Act Appeal."

There is no charge for this information since the total cost of processing your request was less than $14.00. If you have any questions regarding this response, please contact Deborah Johnson, FOIA Coordinator on (202) 564-3691.

Sincerely,

Joyce K Frank

Joyce K. Frank
Principal Deputy Associate Administrator

Enclosures

AL-08-000-3460

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 17 2008

THE ADMINISTRATOR

The Honorable Charles W. Boustany, Jr.
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Boustany:

As required by the Coastal Wetlands Planning, Protection and Restoration Act, I am providing you with a biennial review of the status and effectiveness of the Coastal Wetlands Conservation Plan (Conservation Plan) for the State of Louisiana. This review covers the 2004-05 period.

Our review of the State's efforts to implement the Conservation Plan is based on a series of meetings with officials from the Louisiana Department of Natural Resources (LDNR), analysis of data on permitting and other restoration activities, and our day-to-day coordination and collaboration with LDNR. As with the previous reporting period, we believe the State is meeting the Conservation Plan goal of no net loss of coastal wetlands as a result of development activities. The State met this goal in part by performing additional wetland restoration measures which were above and beyond the mitigation activities required as part of its permit program. Opportunities remain to improve the effectiveness of the Conservation Plan, such as the need to ensure that funds collected by the State for compensatory mitigation purposes are expended expeditiously and effectively. At the same time, we are gratified to see the State taking steps to help protect valuable cypress swamp by developing programs to purchase conservation easements from willing landowners. The enclosure to this letter provides more detail on the effectiveness of the Conservation Plan, along with a discussion of key related issues.

The goal of the Conservation Plan must be understood in the context of the much larger coastal loss crisis in Louisiana. Managing the threats to wetlands from development is an important part of the overall effort of addressing the ongoing loss of Louisiana's coastal wetlands. However, much more needs to be done in terms of wetland restoration if we are to ensure a safe and sustainable future for the residents and nationally important economic assets of coastal Louisiana. Indeed, the catastrophic impacts of hurricanes Katrina and Rita are stark evidence of the need for more extensive coastal restoration efforts in Louisiana. To that end, EPA continues to work closely with the State of Louisiana, our Federal partners, and a wide range of stakeholders to help develop and implement effective coastal restoration plans and projects. At the same time, we are working closely with the Corps of Engineers and others to help expedite the improvement of hurricane protection levee systems. A major challenge in that regard is ensuring that levees and other structural hurricane protection measures are designed in a way that complements rather than conflicts with coastal restoration measures.

Despite the great challenges facing coastal Louisiana, we believe that much can be done to reduce coastal wetland loss and ultimately to help restore the health and sustainability of the coastal ecosystem. Efforts to ensure no net loss from development provide the foundation upon which coastal restoration efforts can be built. We look forward to continuing to collaborate with the State on the Conservation Plan, as well as the broader efforts to restore and protect coastal Louisiana.

We believe that this Report to Congress responds fully to the requirement of Section 304(h)(2) of the Coastal Wetlands Planning, Protection and Restoration Act. If you have any questions, please call me, or your staff may call Christina J. Moody in EPA's Office of Congressional and Intergovernmental Relations at (202) 564.0260.

Sincerely,

Stephen L. Johnson

Enclosure

cc:

Honorable Barbara Boxer
Chairman, Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Honorable James M. Inhofe
Ranking Minority Member, Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Honorable Nick J. Rahall II
Chairman, Committee on Natural Resources
House of Representatives
Washington, D.C. 20515

Honorable Don Young
Ranking Minority Member, Committee on Natural Resources
House of Representatives
Washington, D.C. 20515

Honorable Mary L. Landrieu
United States Senate
Washington, D.C. 20510

Honorable David Vitter
United States Senate
Washington, D.C. 20510

Honorable William J. Jefferson
House of Representatives
Washington, D.C. 20515

Honorable Charlie Melancon
House of Representatives
Washington, D.C. 20515

Honorable Nancy Pelosi
Speaker of the House of Representatives
Washington, D.C. 20515

Honorable Richard B. Cheney
President of the Senate
Washington, D.C. 20510

Louisiana Department of Natural Resources
P.O. Box 94396
Baton Rouge, LA 70804

U.S. Army Corps of Engineers, New Orleans District
P.O. Box 60267
New Orleans, LA 70160

U.S. Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506

U.S. Environmental Protection Agency

2004-05 Biennial Review of the Louisiana
Coastal Wetlands Conservation Plan

Background and Discussion of Key Issues

1. Background

As noted in our cover letter, we believe it necessary to put the Coastal Wetlands Conservation Plan (Conservation Plan) in proper context by briefly describing associated coastal restoration and protection efforts underway in Louisiana. The reason for this is two-fold. First, it is critical that there be coordination and consistency in decisions made in the various programs dealing with Louisiana's coastal wetlands. Second, certain issues we discuss below cannot be fully addressed solely within the context of the Conservation Plan.

A number of hurricane risk reduction and coastal restoration projects have been initiated in the wake of the disastrous 2005 hurricane season. These include two large-scale coastal restoration and protection planning efforts: (1) the ongoing Louisiana Coastal Protection and Restoration (LACPR) study being conducted by the Corps of Engineers, and (2) the recently completed Louisiana Comprehensive Master Plan for a Sustainable Coast (Master Plan). These complementary plans offer roadmaps for the large-scale coastal restoration and hurricane protection projects necessary to ensure a safer and more sustainable future for coastal Louisiana. To help address near-term needs, Louisiana has identified for implementation a range of coastal restoration projects to be funded by the approximately $523 million dollars the State and coastal parishes will receive between 2007 and 2010 pursuant to the Coastal Impact Assistance Program (CIAP). Meanwhile, the Corps of Engineers is proceeding under an expedited National Environmental Policy Act process to elevate the existing New Orleans metropolitan area levee system to a level which would reduce damage from a 100-year hurricane.

These recent activities are in addition to programs initiated prior to 2005, including most notably the Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan) and the Morganza to the Gulf of Mexico Hurricane Protection Project, although in the case of the latter the LACPR effort is reconsidering this project in the broader context of overall hurricane protection for southeast Louisiana. There is also ongoing interagency work to develop and implement coastal restoration projects, including wetland and barrier island restoration projects, pursuant to Section 303 of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). It's worth noting that the expertise and interagency collaboration essential to success in the other coastal restoration efforts described above are largely the product of CWPPRA.

Unlike these restoration efforts, the Conservation Plan is not designed or intended to address the broader, systemic threats to the wetlands, barrier islands, and other natural resources of coastal Louisiana. Rather, the Conservation Plan addresses a relatively small subset of threats, specifically, potential impacts from development activities. But in so doing, the Conservation Plan is critical for both ensuring that public investments in coastal restoration in Louisiana are not undercut by environmentally damaging development projects and for helping to prevent development decisions that would put people and assets in high risk coastal areas.

2. Assessment of Wetland Losses and Gains

In conducting our biennial reviews of the Conservation Plan, EPA relies upon information gathered in biannual meetings with the State and our federal partners, data from written biannual and summary reports from the State, and knowledge gained through our ongoing involvement in both the State and federal permit programs applicable to wetlands in coastal Louisiana.

The Wetland Value Assessment, or WVA, is the primary tool for determining whether the State has met its no-net-loss obligations pursuant to the Conservation Plan. The WVA is a habitat-based assessment methodology which quantifies changes in fish and wildlife habitat quality and quantity that are projected to emerge or develop as a result of a proposed wetland restoration project. The results of the WVA are expressed in Average Annual Habitat Units, or AAHUs.

The following is a summary of the State's WVA scores for the 2004-05 reporting period. The WVA results indicate that the Conservation Plan goal of no net loss has been met and exceeded. The State's non-regulatory restoration activities in this reporting period resulted in substantial wetland gains relative to the impacts and offsets covered by the regulatory program. We encourage the State to continue such non-regulatory efforts, while also working to improve avoidance, minimization and compensation of wetland impacts under its regulatory program. For example, we continue to believe there is opportunity and need to enhance the effectiveness of compensatory mitigation conducted pursuant to the State's regulatory program.

Summary of WVA Scores for the 2004-05 Reporting Period

Activity	AAHUs
Permitted Impacts to Wetland Habitat	-225.1
Mitigation Being Implemented to Compensate for Permitted Losses	237.5
State-Funded Coastal Wetland Restoration Projects	1491.0
Vegetative Planting, Parish Sponsored Restoration Projects, and Christmas Tree Sediment Trapping Projects	366.6

3. Key Conservation Plan Issues Post Hurricanes Katrina and Rita

a. Protecting of Coastal Cypress Swamp

In its 2005 report to Governor Kathleen Babineaux Blanco, a science working group comprised of respected experts in forestry and coastal wetlands concluded that Louisiana's coastal cypress swamps are threatened due to a number of factors.[1] The report identified large-scale alteration of coastal hydrology as the primary cause of decline in the health and sustainability of these coastal swamps. As a consequence, natural regeneration of cypress has been greatly reduced or eliminated throughout large areas of coastal Louisiana. For example, the report contained a preliminary assessment showing that most of the Lake Maurepas swamp is incapable of natural regeneration.

The report reinforced the position long held by numerous scientists and coastal restoration advocates that reintroducing Mississippi River waters into coastal cypress swamps is critical to restoring some degree of health and sustainability to these important wetland areas. The report also served to highlight concerns that cypress logging in coastal Louisiana could in some areas be unsustainable and in other areas unsustainable without intensive forest management efforts. EPA and other stakeholders have been working to reduce the threat of unsustainable logging in Louisiana's coastal cypress swamps. This is in addition to our work with the State to reintroduce Mississippi River water to the Maurepas swamp and other swamps through the CWPPRA program. Efforts to address unsustainable logging can help to protect such public investments in cypress swamp restoration efforts.

Protecting Louisiana's cypress swamps from unsustainable logging can be best accomplished through a combination of regulatory and non-regulatory means. In addition to enforcement of existing laws and regulations, the acquisition of logging rights from willing landowners can help protect vulnerable cypress swamp. As noted in the cover letter to this report, EPA commends the State for taking steps to help protect cypress swamp by developing a Conservation Plan program to purchase conservation easements from willing landowners. This plan, the Louisiana Conservation Servitude Program, would provide approximately $200,000 each year for the conservation of coastal swamp habitat. In addition, the State has proposed using approximately $18 million in CIAP funds for similar coastal forest conservation measures. We understand the State is currently working to coordinate implementation of these two efforts. To that end, we offer our assistance in ensuring the most effective use of these funds by, for example, helping to develop the criteria for selecting candidate sites for forest conservation.

These two actions by the State have the potential to help protect substantial areas of valuable cypress swamp. To that end, we continue to encourage the State to help ensure that existing laws and regulations pertaining to cypress are appropriately enforced, and to implement the aforementioned conservation programs in a way that protects the most vulnerable cypress swamp and, where possible, complements coastal restoration efforts such as the river reintroduction projects discussed above. We look forward to continuing coordination with the State on this matter.

b. Permitting Development in Coastal Wetlands

In the aftermath of hurricanes Katrina and Rita, both the State and federal government play an important role in ensuring that wetland regulatory decisions do not result in an increase in the number of people and properties at risk to coastal flooding. Permitting development in coastal wetlands can incrementally reduce the storm surge and flood attenuation functions provided by such wetlands. The cumulative loss of such functions can increase flooding risks for existing communities.

[1] April 30, 2005, Final Report to the Governor of Louisiana on the Conservation, Protection and Utilization of Louisiana's Coastal Wetland Forests from the Coastal Wetland Forest Conservation and Use Science Working Group.

New development in coastal wetlands is, moreover, itself subject to direct and immediate flooding risk. By definition, coastal wetlands are high risk areas prone to flooding. Authorizing the construction of homes or businesses in such areas essentially allows development in places known to flood. Moreover, when wetlands are drained to make way for development, this flooding risk can increase due to rapid, drainage-related subsidence. A large portion of the flooding in New Orleans during Katrina occurred in areas that were once most likely wetlands, but which were subsequently drained and developed.

The State's Master Plan, which was unanimously approved by the Louisiana legislature, acknowledges that further development in low-lying areas could increase overall levels of risk and would thus be counter to the shared federal and State goal of sustaining the coast and reducing flood risks to communities. According to the Master Plan, this concern for preventing development in wetlands extends even to wetlands within levee systems (which were traditionally viewed by many as suitable areas for development):

> *"Wetland areas inside the hurricane protection system need to remain intact and undeveloped. The most state of the art hurricane protection system can actually increase the assets at risk if it encourages development in wetlands or areas near the levee footprint. Such action would not only be risky from a safety and economic standpoint, but it would also degrade wetlands and eliminate interior flood storage capacity." (Master Plan, page 68)*

We fully recognize the challenges of regulating private property in a fair and effective way. We also recognize that increasing the number of people and properties at risk benefits neither individuals nor communities, and is not in the interest of local, State, and federal governments. Thus, as we work together to restore and protect coastal Louisiana, we strongly encourage the State to ensure that its wetland regulatory decisions are consistent with the Master Plan and do not increase the overall flooding risk to people and properties.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 16 2007

OFFICE OF
THE ADMINISTRATOR

The Honorable Nancy Pelosi
Speaker of the House of
Representatives
Washington, DC 20515

Dear Speaker Pelosi:

I am pleased to submit the enclosed report on the Environmental Protection Agency's (EPA) Fiscal Year 2005 implementation of the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act. The report is required under Section 23(a)(2) of the Act.

The report summarizes the activities and progress EPA has made in fulfilling its responsibilities under the Act and outlines the resources dedicated by the Agency to meet its commitments. Note that the WIPP facility began receiving transuranic radioactive waste on March 26, 1999, and five major waste generator sites have been approved by EPA to ship waste to WIPP.

If you have any questions or comments regarding the enclosed report, please do not hesitate to contact me.

Sincerely,

Stephen L. Johnson

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D C 20460

APR 16 2007

OFFICE OF
THE ADMINISTRATOR

The Honorable Richard B. Cheney
President of the Senate
Washington, DC 20510

Dear Mr. President:

I am pleased to submit the enclosed report on the Environmental Protection Agency's (EPA) Fiscal Year 2005 implementation of the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act. The report is required under Section 23(a)(2) of the Act.

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If you have any questions or comments regarding the enclosed report, please do not hesitate to contact me.

Sincerely,

Stephen L. Johnson

Enclosure

United States
Environmental Protection
Agency

Air and Radiation
(6608J)

EPA 430-R-06-006
April 2007

Implementation of the Waste Isolation Pilot Plant Land Withdrawal Act

FY 2005 Report to Congress

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I. EXECUTIVE SUMMARY

On May 13, 1998, the U.S. Environmental Protection Agency (EPA) certified that the Waste Isolation Pilot Plant (WIPP) can safely contain transuranic (TRU) radioactive waste and complies with EPA's radioactive waste disposal standards. On March 26, 1999, WIPP began receiving radioactive waste. WIPP is the nation's first geologic facility designed for permanent disposal of TRU radioactive waste that was generated as a result of U.S. defense-related activities.

EPA has an ongoing oversight role at WIPP. We independently verify that the U.S. Department of Energy (DOE) maintains and operates the facility in a safe manner, and that the facility continues to comply with our radioactive waste disposal standards. EPA's main oversight activities include:

- Recertifying the safety of WIPP;
- Conducting audits and inspections; and
- Evaluating changes in activities and conditions at WIPP.

On March 26, 2004, EPA received DOE's first Compliance Recertification Application (2004 CRA). A *Federal Register* notice announcing the receipt of the 2004 CRA and opening the public comment period was published on May 24, 2004. The entire 2004 CRA as well as all supporting documentation and correspondence between EPA and DOE are posted on the EPA website. EPA determined the application to be complete on September 29, 2005. Following this completeness determination, EPA is required to issue a recertification decision according to the WIPP Land Withdrawal Act (LWA) within 6 months.

EPA continues to audit, inspect and approve DOE's waste characterization and quality assurance programs. As of the end of fiscal year 2005, EPA has approved the following TRU waste sites: (1) Hanford Site in Washington (Hanford), (2) Idaho National Laboratory (INL), (3) Los Alamos National Laboratory (LANL), (4) Rocky Flats Environmental Technology Site (RFETS) in Colorado, and (5) Savannah River Site (SRS) in South Carolina. In addition, the Nevada Test Site (NTS), Lawrence Livermore National Laboratory (LLNL), Argonne National Laboratory-East (ANL-E) in Illinois, LANL, and SRS were approved to dispose of waste characterized by the Central Characterization Project (CCP) at WIPP.

Highlights for EPA's WIPP program in Fiscal Year (FY) 2005 include:

- EPA conducted 11 audits of WIPP Quality Assurance programs and determined that they had been properly maintained.
- EPA conducted 6 inspections of waste characterization activities at DOE waste generator sites. The inspections were conducted to ensure continued compliance with EPA regulations at approved sites and to approve new waste characterization programs and activities.
- In 2005, EPA inspected WIPP and verified compliance with the monitoring and waste emplacement requirements of the certification, and with Subpart A requirements of 40 CFR Part 191.

- Completed evaluation of DOE's FY 2004 Annual Change Report and notified DOE that the changes to WIPP were not significant and did not require modification, suspension, or revocation of the WIPP Certification Decision.

- Finalized the completeness determination regarding DOE's 2004 Compliance Recertification (2004 CRA) and initiated the technical review of the 2004 CRA.

- Performed the first baseline inspection at the Advanced Mixed Waste Treatment Project operated by the Central Characterization Project at the Idaho National Laboratory under the revised 40 CFR Part 194.

- In FY 2005, EPA funded 10 in-house staff positions at EPA Headquarters and EPA's Region 6 office in Dallas, TX. Although not required, DOE transfers multi-year funds to EPA through an Interagency Agreement to support EPA's WIPP oversight. In FY 2005, EPA obligated $1,340,900 of these funds to fulfill our responsibilities under WIPP LWA.

II. INTRODUCTION

With this report the U.S. Environmental Protection Agency (EPA, Agency or we) complies with the requirement in Section 23(a)(2) of the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act, Pub. L. No. 102-579 (LWA), which requires EPA to submit an annual report to the Congress "on the status of, and resources required for the fulfillment of the Administrator's responsibilities under this Act."

The Act, as amended in 1996, gives EPA the authority to oversee many of the U.S. Department of Energy's (DOE) activities at WIPP throughout the facility's operational and decommissioning phases. WIPP, located in southeastern New Mexico, is operated by DOE as a long-term geologic disposal facility for transuranic (TRU) radioactive waste. TRU waste is long-lived radioactive waste generated as by-products from nuclear weapons production and decommissioning.

The Act requires EPA to take the following regulatory actions:

- <u>Issue Radioactive Waste Disposal Standards</u>
  Develop environmental radiation protection standards for the disposal of spent nuclear fuel, high-level and transuranic (TRU) radioactive waste, which will apply to all potential disposal sites except the site identified in Section 113(a) of the Nuclear Waste Policy Act, as amended (completed 09/19/1985, 40 CFR Part 191).

- <u>Develop Compliance Criteria</u>
  Establish criteria to determine whether WIPP will comply with the Agency's radioactive waste disposal regulations (completed 02/01/1986, 40 CFR Part 194).

- <u>Conduct a Compliance Certification</u>
  Certify by rulemaking whether or not WIPP complies with the Agency's radioactive waste disposal regulations (completed 05/18/1998, 63 FR 27354).

- <u>Recertify Periodically</u>
  Determine every five years whether or not WIPP continues to be in compliance with the Agency's radioactive waste disposal regulations (the first recertification process began in March 2004).

In addition to these regulatory actions, EPA must determine whether documentation submitted by DOE pursuant to Section 9(a)(2) of the Act demonstrates continued compliance with environmental laws, regulations, and permit requirements as described in Section 9(a)(1) of the Act.

This report summarizes the activities EPA performed during FY 2005 (October 1, 2004 - September 30, 2005) in order to fulfill its responsibilities under the WIPP LWA and to provide independent regulatory oversight of the disposal of radioactive waste at WIPP. Beginning in 1992 with the passage of the WIPP LWA, EPA has submitted annual Reports to Congress each year. For a description of EPA's WIPP activities and accomplishments prior to FY 2004, please refer to these previous reports.

III. EPA'S WIPP REGULATORY AND OVERSIGHT ACTIVITIES

A. Management

The Office of Radiation and Indoor Air (ORIA), located in the Office of Air and Radiation (OAR), is charged with the primary responsibility for implementing the LWA and ensuring that EPA's oversight responsibilities are performed in a timely and scientifically-credible manner. Other EPA offices with significant roles are the Office of General Counsel (OGC) and EPA Region 6. Region 6, together with the State of New Mexico, regulates WIPP's compliance with the Resource Conservation and Recovery Act (RCRA). Region 6 also oversees DOE's demonstration of compliance with all other applicable Federal environmental laws.

Within ORIA, the Center for Federal Regulations in the Radiation Protection Division (RPD) executes most of EPA's responsibilities under the LWA. RPD's Outreach Team leads EPA's WIPP public outreach efforts.

B. Resources

The Act authorized DOE to transfer funds appropriated for environmental restoration and waste management to the EPA through the year 2001 for fulfilling the responsibilities of the Administrator under the Act. Since 2001, DOE, although not required, has transferred multi-year funds to EPA through interagency agreements (IAG) to support our oversight of WIPP. In FY 2005, under the current IAG, DOE provided funds to support EPA's continuing regulatory oversight of WIPP, including recertification, conducting quality assurance (QA) and waste characterization (WC) inspections and attending various WIPP-related technical meetings. The resources required to fulfill EPA's responsibilities under the Act are highly dependent on DOE's schedule and can fluctuate greatly from year to year because of the number of sites requiring inspection each year, proposed DOE changes to WIPP, and the required recertification every five years. In FY 2005, EPA obligated approximately $1,340,900 from the IAG with DOE to fulfill our responsibilities under the WIPP LWA.

C. Continuing Compliance

In 1998, EPA certified that WIPP will comply with the radioactive waste disposal regulations in 40 CFR Part 191 and 40 CFR Part 194. EPA continues to monitor WIPP's compliance with EPA's radioactive waste disposal standards. This oversight includes conducting audits and site inspections, reviewing annual change reports, and determining every five years if WIPP should be recertified.

Recertification

In FY 2005 EPA continued to review DOE's 2004 Compliance Recertification Application (2004 CRA) for completeness. EPA sent six letters to DOE requesting additional information for the 2004 CRA. These requests for additional information and DOE's subsequent responses are available for review in EPA's dockets and from the EPA website. Based on the additional information DOE provided, EPA was able to determine that the 2004 CRA was complete on September 29, 2005. EPA is required to issue its decision on recertification six months after the Agency determines that DOE's recertification application is complete.

The public comment period on DOE's recertification application was open from May 24, 2004, through the end of FY 2005. The Agency will make its recertification decision based on the results of our continuous oversight of WIPP, on complete documentation provided by DOE, and on public input. The Agency's decision on recertification will be announced on EPA's WIPP website, the WIPP-NEWS e-mail listserv, and also in the *Federal Register*. EPA will conduct recertifications of WIPP every five years until the end of the operational phase of the repository.

Quality Assurance Audits

EPA requires DOE (40 CFR Part 194.22) to establish and implement a quality assurance (QA) program for all items and activities that are important to the long-term containment of TRU waste in the disposal system. DOE's QA program must implement the applicable requirements of specific Nuclear Quality Assurance (NQA) standards issued by the American Society of Mechanical Engineers (ASME). QA is a process for DOE to independently verify the reliability of items and activities, such as technical data and analyses that are important to the long-term containment of TRU waste.

The Agency verified that DOE established these QA requirements in the Quality Assurance Program Document (QAPD) included in the Compliance Certification Application for WIPP. The QAPD is the documented QA plan for WIPP project, as a whole, to comply with the NQA requirements. The QAPD is maintained by the QA organization of DOE's Carlsbad Field Office (CBFO), which has the authority to audit all other organizations associated with TRU waste disposal at WIPP to ensure that their lower-tier quality assurance programs establish and implement the applicable requirements of the QAPD. The other DOE organizations such as the generator sites, which characterize waste for disposal at WIPP, must have site-specific QA plans.

Once EPA has approved the QA program of a particular site, the Agency audits it on an annual basis to verify that the program is properly maintained. In 2005, EPA completed QA audits at the eleven waste generator sites that are approved to ship waste to WIPP and found that they were properly maintaining their QA programs for WC.

Site Inspections

There are approximately 20 major sites across the country that store TRU waste. CBFO determines which sites are eligible to ship waste to WIPP and audits them for compliance with DOE requirements. As CBFO certifies each site, EPA inspects the site to determine whether it also meets EPA's certification requirements.

During FY 2005, EPA inspected the following four TRU sites with an EPA-approved waste characterization program for continued compliance: (1) the Advanced Mixed Waste Treatment Project (AMWTP) at the Idaho National Laboratory, (2) the Hanford site in Washington, (3) the

Los Alamos National Laboratories (LANL), and (4) the Savannah River Site in South Carolina. In addition, EPA conducted a baseline inspection according to the revised site inspection requirements at 40 CFR 194.8 promulgated in July 2004 of debris and solid waste from AMWTP that was characterized by CCP.

Change Reports

EPA requires that DOE report any planned or unplanned changes in activities or conditions on which EPA's Compliance Certification decision was based on 40 CFR Part 194.4(b)(4). EPA provided DOE with reporting guidance on September 30, 1998, and placed it in EPA's public dockets. EPA reviews information about the changes and determines whether the initial certification should be modified, suspended, or revoked. Often, DOE makes changes to their activities to make improvements or increase efficiency, and in most cases, these changes are insignificant. The Agency may ask for public comment to assist in its review. Records of changes to WIPP that EPA has reviewed since 1998 have been placed in the public dockets.

DOE submitted its 2004 Annual Change report to EPA on November 17, 2004. EPA reviewed this report and requested additional information. Following a review of the additional information, EPA notified DOE on September 21, 2005, that the changes did not require a modification, suspension, or revocation of EPA's certification decision. Most of the changes described in the report were associated with modifications to written plans and procedures, required monitoring activities, and upcoming changes that DOE was considering.

D. 40 CFR Part 191, Subpart A: Standards for the Management and Storage of Spent Nuclear Fuel, High-Level and Transuranic Waste

Subpart A of 40 CFR Part 191 contains EPA's environmental standards for the management and storage of spent nuclear fuel, high-level and TRU waste at disposal facilities operated by DOE. For WIPP, these standards apply to activities during the operational period of the facility, including when waste arrives at the above-ground portion of WIPP, is unloaded and prepared for disposal in the underground repository, and is lowered down the shaft and emplaced in the underground disposal rooms.

To implement Subpart A, EPA and DOE are following EPA's WIPP Subpart A guidance, issued in January 1997, which interprets the standard specifically for WIPP. (See 62 FR 9188.) As recommended by this guidance document, DOE notified EPA when initial startup of WIPP was expected. In March 1999, prior to start-up occurring, EPA performed an on-site inspection of WIPP to verify DOE's start-up readiness and its ability to capture, measure, and calculate any potential releases during waste disposal operations. EPA inspections found that WIPP was ready to receive waste and that DOE was able to monitor compliance with Subpart A. Thereafter, EPA has performed Subpart A inspections on an annual basis.

In July 2005, EPA performed a Subpart A inspection to verify DOE's continued compliance with the Subpart A requirements. The inspectors found that DOE, through its contractor Washington TRU Solutions, had an effective radiation sampling program, calculated doses estimates adequately, and that the procedures and documentation were technically adequate.

In the future, DOE will continue to monitor the WIPP facility to detect any potential releases of radioactive materials. If any releases occur and cause radiation doses exceeding the Subpart A limits, then DOE will implement a "remedial plan" and submit monthly reports to EPA until the issue is resolved to EPA's satisfaction. Otherwise, DOE will report on compliance with Subpart A as part of the Biennial Environmental Compliance Report (BECR).

E. Compliance with the Resource Conservation and Recovery Act

Substantial portions of the wastes proposed for disposal at WIPP are mixed waste, which contain both hazardous waste subject to the Resource Conservation and Recovery Act (RCRA) and radioactive waste subject to the Atomic Energy Act (AEA). WIPP, therefore, must also comply with regulations developed under RCRA. This section describes EPA's implementation of RCRA requirements.

EPA authorized the State of New Mexico to carry out the State's base RCRA program and the State's mixed waste program in lieu of the respective Federal programs. Therefore, the State issues and implements the RCRA permit for the WIPP. EPA's

Region 6 office provides oversight and technical assistance to the State in implementing this permit.

Under the permit, the State of New Mexico audits the DOE inspections of the generator sites contributing waste to the WIPP. The State approves each site that demonstrates adequate compliance with the requirements in the permit and monitors DOE's audit program and documentation.

F. Compliance With Other Federal Environmental Laws

The LWA requires DOE to submit documentation to EPA – and, where applicable, the State of New Mexico – every two years to demonstrate the WIPP's compliance with all applicable Federal environmental laws, regulations, and permit requirements, including: the radioactive waste management and storage regulations (40 CFR Part 191, Subpart A); the Clean Air Act; the Toxic Substances Control Act; the Comprehensive Environmental Response, Compensation, and Liability Act; the Solid Waste Disposal Act; and the Safe Drinking Water Act. This documentation must be submitted throughout the disposal and decommissioning phases of the WIPP. DOE provides this information to EPA in its "Biennial Environmental Compliance Report" (BECR). EPA (and, where applicable, the State of New Mexico) must make a determination of compliance with these statutes, regulations, and permit requirements within six months of receiving DOE's BECR. If EPA determines that the WIPP does not comply with any applicable Federal law, regulation or permit requirement, the Agency will require DOE to develop a remedial plan within six months of such a determination.

DOE submitted the BECR for 2002-2004 to EPA on October 31, 2004. EPA determined that based on the report, WIPP remains in compliance with all applicable Federal environmental laws, regulations, and permit requirements.

IV. COMMUNICATION AND CONSULTATION ACTIVITIES

EPA continues to inform interested parties about its WIPP oversight functions and encourage public participation in its oversight role and activities.

In June 2005, EPA sponsored public meetings in Albuquerque, New Mexico, to provide updated information about the Agency's recertification review process and timeline, and also the content of DOE's compliance recertification application. The meetings were a follow-up to the July 2004 meetings, which offered presentations and poster sessions, as well as facilitated discussions related to WIPP recertification. At the request of the stakeholders, DOE participated in these meetings. Meeting participants were invited to provide comments to EPA for our consideration during review of DOE's WIPP recertification application. Public participants commented that the meeting development process, format and execution were a good model for public involvement.

EPA's toll-free WIPP Information Line (1-800-331-WIPP) provides up-to-date, recorded information about public hearings and meetings, publications, and other WIPP activities. Callers listen to recorded messages, add their name to the WIPP mailing list, request a WIPP publication, or leave a question for EPA staff.

In an ongoing effort to keep the public well-informed, EPA regularly places all pertinent information about the WIPP in the official docket at EPA Headquarters in Washington, DC and informational dockets located in Carlsbad, Albuquerque, and Santa Fe, New Mexico. Updated information can also be found at EPA's WIPP Web Site at <http://www.epa.gov/radiation/wipp>. The website also has information on joining the WIPP-NEWS listserv, which periodically sends emails to registered subscribers on the latest WIPP updates. EPA has also published Fact Sheets on the Agency's continuing regulation of WIPP. We maintain a WIPP mailing list, which currently has over 2000 subscribers.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 12 2008

THE ADMINISTRATOR

The Honorable Nancy Pelosi
Speaker of the House of
Representatives
Washington, DC 20515

Dear Speaker Pelosi:

In accordance with Section 603(d) of Title VI – Stratospheric Ozone Protection of the Clean Air Act Amendments of 1990, I am pleased to submit the enclosed Report to Congress. The report provides information on the production, use and consumption of class I and class II substances, as well as a description of the environmental and economic effects of any stratospheric ozone depletion.

As a source of additional information on the environmental and economic effects of stratospheric ozone depletion, I am also attaching to the report the executive summary from the most recent "Scientific Assessment of Ozone Depletion: 2006" and the executive summaries of the 2006 Assessments from both the Technical and Economic Assessment Panel and the Environmental Effects Assessment Panel, advisory bodies to the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer.

In summary, domestic rules and programs implemented by EPA are ensuring the success of the phase out of ozone-depleting substances and discovery of alternatives. In the United States, production and consumption of class I ozone-depleting substances are virtually at zero, with only very limited amounts that are permitted as exemptions under the Montreal Protocol. EPA expects to continue progress both in identifying alternatives for several key uses and in phasing out the class II ozone-depleting hydrochlorofluorocarbons (HCFCs).

If you have any questions or comments regarding the enclosed report, please do not hesitate to contact me.

Sincerely,

Stephen L. Johnson

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 12 2008

THE ADMINISTRATOR

The Honorable Richard B. Cheney
President of the Senate
Washington, DC 20510

Dear Mr. President:

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In summary, domestic rules and programs implemented by EPA are ensuring the success of the phase out of ozone-depleting substances and discovery of alternatives. In the United States, production and consumption of class I ozone-depleting substances are virtually at zero, with only very limited amounts that are permitted as exemptions under the Montreal Protocol. EPA expects to continue progress both in identifying alternatives for several key uses and in phasing out the class II ozone-depleting hydrochlorofluorocarbons (HCFCs).

If you have any questions or comments regarding the enclosed report, please do not hesitate to contact me.

Sincerely,

Stephen L. Johnson

Enclosure

REPORT TO CONGRESS:
STRATOSPHERIC OZONE PROTECTION –
TITLE VI OF THE CLEAN AIR ACT AMENDMENTS OF 1990

U.S. Environmental Protection Agency

TITLE VI – STRATOSPHERIC OZONE PROTECTION
CLEAN AIR ACT AMENDMENTS OF 1990
REPORT TO CONGRESS

Contents

TITLE VI – STRATOSPHERIC OZONE PROTECTION
CLEAN AIR ACT AMENDMENTS OF 1990
REPORT TO CONGRESS

I. Purpose

This report to Congress provides current information and estimates of domestic and international production, use, and consumption of class I and class II ozone-depleting substances, in accordance with Title VI – Stratospheric Ozone Protection, Section 603(d) of the Clean Air Act Amendments of 1990. Section 603(d) requires a report to Congress not less frequently than every three years addressing the use and consumption of class I and class II ozone-depleting substances. Section 603(d) also requires a report to Congress no less often than every six years addressing the environmental and economic effects of stratospheric ozone depletion. This report to Congress, along with its appendices, is intended to satisfy both requirements. To provide further information about the status of stratospheric ozone depletion, the use and consumption of ozone-depleting substances, and the environmental and economic effects of stratospheric ozone depletion, we are also submitting several documents as appendices that are described below. EPA staff and other U.S. experts continue to play a prominent role in the compilation of these documents. However, the submission of these additional documents with this Report to Congress does not constitute an endorsement of their content as the Agency's position.

The World Meteorological Organization (WMO) issued a report that assesses the status of stratospheric ozone depletion, "Scientific Assessment of Ozone Depletion: 2006.[a]" The "Scientific Assessment" is prepared under the international auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) as information for the signatory Parties to the international treaty the *Montreal Protocol on Substances that Deplete the Ozone Layer* (Montreal Protocol).

The environmental effects of ozone depletion are described in the attached Executive Summary of the "Environmental Effects of Ozone Depletion and its Interactions with Climate Change: 2006 Assessment" prepared under the international auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to be used by the Parties to the Montreal Protocol in making ozone protection decisions.

Information on global economic effects of stratospheric ozone depletion and details on the production and consumption of class I and class II ozone-depleting substances is in the attached Executive Summary of "2006 Assessment Report of the Technology and Economic Assessment Panel," also published under the auspices of UNEP.

II. Introduction

The ozone layer acts as a shield in the stratosphere protecting the planet from harmful ultraviolet (UV) radiation. Scientists have found that certain chlorine and bromine containing chemicals

[a] The complete Scientific Assessment is available at
http://ozone.unep.org/Assessment_Panels/SAP/Scientific_Assessment_2006/index.shtml

rapidly destroy the layer of ozone in the stratosphere. Scientific evidence shows that degradation of the ozone layer, which increases the amount of ultraviolet radiation reaching the Earth's surface, is associated with greater incidence of skin cancer, cataracts, and to impaired immune systems. Increased global exposure to UV radiation also reduces crop yields and diminishes the productivity of the oceans. (See the attached executive summaries from the "Scientific Assessment of Ozone Depletion: 2006," and the "Environmental Effects of Ozone Depletion and its Interactions with Climate Change: 2006 Assessment.")

Certain industrial processes and consumer products result in the atmospheric emission of "halogen source gases." These gases contain chlorine and bromine atoms, which are known to be harmful to the ozone layer. For example, chlorofluorocarbons (CFCs), which were once used in almost all refrigeration and air conditioning systems, eventually reach the stratosphere, where they are broken apart to release ozone-depleting chlorine atoms. Other examples of human-produced ozone-depleting gases are halons, which are used in fire extinguishers and which contain ozone-depleting bromine atoms.

The United States was one of the initial signatories of the international treaty the *Montreal Protocol on Substances that Destroy the Ozone Layer* (Montreal Protocol). There are now over 190 signatory countries to the Montreal Protocol. Under this treaty, developed countries agreed to phase out production of class I ozone-depleting substances, those most damaging to the stratospheric ozone layer, by the end of 1995. Developing countries are in the midst of phasing out class I ozone-depleting substances. Other substances that deplete the ozone layer are scheduled under the Montreal Protocol to be phased out in the future.

As a result of the Montreal Protocol, the total abundance of ozone-depleting gases in the atmosphere has begun to decrease in recent years. If the nations of the world continue to follow the provisions of the Montreal Protocol, the decrease will continue throughout the 21st century. Some individual gases such as halons and hydrochlorofluorocarbons (HCFCs) are still increasing in the atmosphere, but will begin to decrease in the next few decades if compliance with the Protocol continues.[1]

Signatory Parties to the Montreal Protocol recognized the need for periodic updates on the status of the transition from ozone-depleting substances and on the state of the stratospheric ozone layer. The Parties to the Montreal Protocol created assessment panels under the auspices of the United Nations Environment Programme (UNEP) to provide these periodic updates of global information. UNEP provides leadership and encourages multilateral partnership in addressing this global environmental problem by implementing the Montreal Protocol and coordinating meetings. The Technology and Economic Assessment Panel (TEAP), organized under UNEP in accordance with the Montreal Protocol, is responsible for issuing regular reports on progress in implementing the phaseout of ozone-depleting substances. The reports, compiled by both the TEAP and the Scientific Assessment Panel, provide the foremost research concerning ozone depletion and its environmental and economic impact but their submission as part of this report to Congress does not mean their content constitutes the agency's position.

III. Overview of U.S. Stratospheric Ozone Protection Efforts

A. Regulatory Activities

Title VI of the Clean Air Act Amendments of 1990 directs the U.S. Environmental Protection Agency to create a regulatory program to protect stratospheric ozone and meet the requirements of the Montreal Protocol. These domestic rules and programs implemented by the U.S. Environmental Protection Agency (EPA) are phasing out ozone-depleting substances and assisting in the discovery of safe and environmentally suitable alternatives. Rules implementing the major provisions of Title VI have been promulgated addressing: (1) the phaseout of ozone-depleting substances; (2) the recovery, recycling, and reclamation of refrigerants to reduce emissions; (3) the recycling of refrigerant from motor vehicle air-conditioning; (4) the ban on nonessential products; (5) the labeling of products containing or made with ozone-depleting chemicals; (6) a program to determine acceptable substitutes for ozone-depleting substances; and (7) restrictions on federal procurement of ozone-depleting products. Future rules and activities will address complex implementation issues and are expected to reflect advancements in technology, development of new alternatives, and facilitation of the phase out of production and import of hydrochlorofluorocarbons (HCFCs). Globally, continued efforts to protect ozone in the stratosphere, including amendments and adjustments to the terms of the Montreal Protocol, are contributing to recovery of the ozone layer.

EPA's stratospheric ozone protection program has made significant progress in phasing out the production and import of chemicals that damage the ozone layer: chorlofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, bromochloromethane and methyl bromide. Education and outreach programs have facilitated a smooth transition to alternatives to ozone-depleting substances and continue to keep stakeholders aware of the important issues.

EPA's Significant New Alternatives Policy (SNAP) program continues to list alternatives to ozone-depleting substances along with in-depth technical reviews to encourage industry to shift toward more environmentally-friendly materials. In the eight industry sectors that historically used ozone-depleting substances, the SNAP program has listed more than 400 acceptable substitutes. The SNAP program has gained widespread acceptance among industry -- both domestic and international. Manufacturers and vendors of alternatives frequently use the acceptance of their products by the SNAP program in promotional material.

B. Voluntary and Educational Programs

EPA's SunWise Program provides cross-curricular, standards-based educational tools to over 17,000 elementary and middle schools in the United States to educate children on how to protect oneself from the sun, the role of the stratospheric ozone layer, and ultraviolet radiation. The Ultraviolet Index (UV Index), developed by EPA and the National Weather Service, gives people information to protect themselves from overexposure to the sun's harmful UV radiation.

EPA uses the Ozone Depletion Website and other publications to provide information to consumers, industry, and government institutions on all aspects of the stratospheric ozone protection program, including regulatory controls on production and import of ozone-depleting substances, the recovery and recycling of these substances, the status of alternative chemicals and technologies, and how to protect oneself from the sun's harmful ultraviolet radiation.

EPA is providing support to developing nations to meet their commitments under the Montreal Protocol and to regulate the commerce of ozone-depleting substances. EPA continues to provide bilateral technical assistance, training, and equipment through the Protocol's multilateral fund to help developing countries achieve the goals set in the Montreal Protocol to reduce production and import of ozone-depleting substances.

C. Enforcement Activities

EPA coordinates a partnership with the Department of Justice, the Internal Revenue Service, the Customs Service, the Defense Logistics Agency, the Commerce Department, and the State Department to combat illegal imports of ozone-depleting substances. The success of U.S. efforts to stop the flow of illegal imports is largely due to the effectiveness of this partnership. Since 1998, these agencies working together have convicted or elicited guilty pleas from more than 119 people, with an aggregate of 76 years of jail time, and seized more than 1.9 million pounds of illegally imported substances. These enforcement actions and stiff penalties have had a significant deterrent effect on illegal imports into the U.S. of ozone-depleting substances based on the significant reduction in the number of unsolicited reports of illegal imports from U.S. industry stakeholders. Other recent EPA enforcement actions resulted in numerous prosecutions and penalties for the following crimes: use of unacceptable refrigeration alternatives, improper recycling of refrigerants, and the illegal disposal of equipment without removing the refrigerant.

IV. Production, Use, and Consumption of Class I and Class II Substances

The Montreal Protocol and the Clean Air Act list chemicals that are damaging to stratospheric ozone. The Clean Air Act categorizes these chemicals as *class I* and *class II* controlled substances. Class I controlled substances are generally more damaging to the ozone layer and have higher ozone-depleting potentials (ODP) than class II substances. Class I substances are: chlorofluorocarbons (CFCs), halons, methyl chloroform, methyl bromide, carbon tetrachloride, chlorobromomethane, and hydrobromofluorocarbons (HBFCs). Class II substances are all hydrochlorofluorocarbons (HCFCs).

The Parties to the Montreal Protocol allow exemptions to the phase out of production and import of ozone-depleting substances for certain uses, such as medical devices, laboratory and analytical procedures, feedstock chemicals for making non-ozone-depleting chemicals, and agricultural uses. Progress continues in finding alternatives for these specialized uses. For example, seven individual metered-dose inhalers without CFCs have now been registered by U.S. Food and Drug Administration for the treatment of asthma and chronic pulmonary obstructive disease.

In transitioning to substances that are less damaging to the ozone layer many industries and technologies moved to less damaging hydrochlorofluorocarbons (HCFCs). The properties of HCFCs are similar to CFCs but the HCFCs are on average more than 80 percent less damaging to the stratospheric ozone layer. Although HCFCs have been important in phasing out CFCs, they still damage the ozone layer and are scheduled under the Montreal Protocol to be phased out by 2030 in developed countries and by 2040 in developing countries. In the U.S., EPA is meeting the Montreal Protocol schedule for HCFC reductions by accelerating the phaseout of the three most damaging HCFCs: HCFC-141b, HCFC-142b, and HCFC-22. For this reason, EPA does not encourage the use of HCFCs where other more environmentally appropriate technologies exist.

A. Domestic and International Status of Production and Consumption

U.S. production and consumption of class I and class II chemicals are monitored through EPA's marketable allowance tracking system. Consumption is defined as the formula:

Consumption = Production plus Imports minus Exports.

Production is defined as the manufacture of specific controlled chemicals but does not include quantities produced to be used as a feedstock in making non-ozone-depleting substances.

The incremental phase down of production and import of ozone-depleting substances under the Montreal Protocol and EPA regulations was implemented to restrict market supply with an expectation that it would result in price increases that would stimulate the adoption of alternatives. In fact, by the late 1990s prices of some ozone-depleting substances did increase in developed countries, fostering the transition to new technologies.

In 1994 the U.S. eliminated the production and import of halons, and in 1996 the U.S. eliminated the production and import of all CFCs, methyl chloroform, carbon tetrachloride, and hydrobromofluorocarbons, except for limited exemptions. A 2003 EPA regulation banned chlorobromomethane production and import, and in 2005 U.S. production and import of methyl bromide was phased out except for exemptions permitted under the Montreal Protocol and the Clean Air Act.

Hydrochlorofluorocarbons (HCFCs) are considered transition chemicals for refrigeration, air-conditioning and other uses, and U.S. industry recognizes that these substances are scheduled to be phased out by 2030. By essentially banning production and import of HCFC-141b in a January 2003 regulation, the U.S. surpassed Montreal Protocol obligations to reduce national HCFC consumption by 35 percent beginning in 2004.

B. Uses of Class I and Class II Substances

EPA briefly summarizes the status of predominant uses of the ozone-depleting chemicals based on a more detailed information presented in the WMO's "2006 Assessment Report of the Technology and Economic Assessment Panel."

Fire Suppression: The atmospheric abundance of Halon-1211 and Halon-1301 constitutes a significant portion of all bromine-containing source gases in the stratosphere, and continues to grow despite the cessation in 1994 of halon production in developed nations. The measured growth in atmospheric abundance continues because substantial halon reserves held in fire-extinguishing equipment are gradually being released, and because of past production in developing nations that has now been phased out with assistance from the Multilateral Fund.

The phaseout of halons in developed countries began before substitutes and alternatives became available for all critical halon uses. As research continues into alternatives, EPA continues to work with industry to foster recovery, recycling, and management of stockpiles of halons for vital uses.

Aerosol Products: Hydrocarbons are the predominant propellant for household aerosol products, such as spray paints, pesticides, and personal-care products. No technical barriers exist to worldwide transition to alternatives for aerosol products, but due to the long and detailed approval processes required by health authorities, some metered dose inhalers (MDIs) continue to use CFCs for the treatment of asthma. CFC use in developing countries (which, under Article 5(1) of the Protocol, have 10 additional years to phase out production and importation) continues to be addressed by the Parties; significant reductions are underway.

CFC-based MDIs were recognized by the Parties as an essential use for which limited and monitored production may continue. Doctors consider MDIs to be the most effective option for people who suffer from respiratory diseases, such as asthma and chronic obstructive pulmonary disease. New alternative propellants for use in MDIs are being introduced in developed and developing countries and a reduced need for CFC-containing MDIs is anticipated worldwide with a complete transition possible shortly after 2010.

Rigid and Flexible Foams: Significant progress has been made in phasing out ozone-depleting substances in the foam sector. CFCs were phased out of most foam products, other than thermal insulating foams, by mid-1996 in the U.S. and other developed nations. With support from the Montreal Protocol's Multilateral Fund, phaseout projects in developing countries have successfully converted facilities away from using CFCs.

Substitutes that are not ozone depleting are the alternative of choice for cushioning, packaging, integral skin, and for some insulating foams. In Europe, Japan, and Australia, there is widespread use of hydrocarbons for appliance foam and in some construction foam. However, the U.S. rigid foam insulation industry, which includes construction, appliance and spray foam, has transitioned to HCFCs and is also transitioning to zero-ODP alternatives in most applications. The transition was spurred by the first control measure under the Protocol for the reduction of HCFCs. In order to meet the Protocol's control targets reductions, the U.S. developed an approach to phase out the most ozone depleting HCFCs first. In January 2003, production and import of HCFC-141b, a common foam blowing agent, was phased out in the U.S. At that time, EPA established an exemption process for U.S. government agencies and non-governmental space vehicle entities to petition for limited continued production and import of HCFC-141b beyond the phaseout date where there are no technically available alternatives.

Sterilization: CFC blends for sterilization have been successfully phased out in most industrialized and in most developing countries. For most applications there are a number of widely-used alternatives that are free of ozone-depleting substances.

Refrigeration, Air-Conditioning, and Heat Pumps: As of 1995, all new refrigeration and air-conditioning equipment manufactured in developed countries are using HCFCs, HFCs, or other not-in-kind (NIK) technologies such as evaporative cooling and absorption technologies. While CFC production is banned under the Protocol, there is a substantial inventory of existing CFCs used in commercial and transport refrigeration equipment, chillers, and mobile air-conditioning systems. Such equipment will eventually be replaced or retrofitted, but continued recycling, recovery at disposal, and CFC banking minimizes the cost of the transition for companies and consumers. The recovery, recycling, and banking of CFCs mean companies and consumers aren't faced with a premature abandonment of equipment before the end of its useful life. However, lack of availability of CFCs should cause their cost to increase, fostering the transition to new technologies.

Solvents, Coatings, and Adhesives: Developed country suppliers and consumers of ozone-depleting solvents have essentially halted production of CFC-113 and, with limited exceptions, methyl chloroform. This achievement was made possible in part by the leadership of policy makers in defense ministries, who recognized the potential impacts on national security of continued dependency on chemicals that will be increasingly expensive and eventually unavailable. A variety of alternatives to ozone-depleting solvents are available that vary in price and in how widely they can be used. Exemptions allowing production and consumption have been granted by the Parties for laboratory and analytical uses, and for Space Shuttle rocket manufacturing and maintenance.

Methyl chloroform was commonly used as a solvent and as a degreaser in industrial cleaning operations. Because of the large quantities that were used for these applications it was one of the most damaging of the ozone-depleting substances. Along with many other class I substances, methyl chloroform was phased out in 1996 in the U.S. and other industrialized countries. Most developing countries have also phased out methyl chloroform production and import.

Methyl Bromide: Methyl bromide is used primarily as a fumigant and pesticide. This use includes soil fumigation in agriculture, treatment of durable commodities (e.g., grain, timber) and perishables (e.g., fresh fruit, cut flowers), quarantine treatment of commodities, and treatment of structures and transport containers. No single alternative chemical treatment has been identified that can duplicate the action of methyl bromide in all of the various applications. There are, however, alternative chemicals and production methods that can replace methyl bromide to a substantial degree in many use areas.

EPA is working to implement a smooth transition from methyl bromide in part by creating sensible safety valves to the phasedown and phaseout of methyl bromide. EPA is devoting extensive time and resources to the two phaseout exemption programs for vital methyl bromide uses: the quarantine and preshipment exemption (QPS) and the critical use exemption (CUE).

Quarantine and preshipment uses of methyl bromide are completely exempt from the phaseout because the chemical is used to meet official requirements that protect against the introduction of invasive species through trade. Other users of methyl bromide without technically and economically feasible alternatives may obtain an authorization for a critical use exemption that permits new production and import of the chemical after the 2005 phaseout.

Carbon Tetrachloride: Carbon tetrachloride (CTC) is used almost entirely as a feedstock in the production of CFC-11 and CFC-12, and in the production of certain pesticides, pharmaceuticals, chlorine, and perchloroethylene (PCE). The manufacture of CTC was banned in developed countries in 1996, with the exception of CTC used as feedstock and as process agents. Controlled substances used as process agents are used in a manner similar to feedstocks, but this use results in small amounts of emissions. Although the Montreal Protocol does not restrict production and import of controlled substances used as process agents, their emissions must be reduced to insignificant levels. CTC is currently used as a process agent in the production of chlorosulphonated polyolefin and chlorine. Due to the phaseout of CFCs, CTC use as a feedstock has diminished, and current levels of CTC use as a process agent produce negligible emissions.

V. Effects of Stratospheric Ozone Depletion

The environmental effects of ozone depletion are described in the enclosed Executive Summary of the "Environmental Effects of Ozone Depletion and its Interactions with Climate Change: 2006 Assessment." Because elevated levels of ultraviolet radiation reach the earth's surface due to ozone layer depletion, the world's leading photobiological and photochemical experts prepared this report under the international auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to be used by the Parties to the Montreal Protocol in making ozone protection decisions.

Numerous laboratory investigations, atmospheric observations, and theoretical and modeling studies have produced new findings and have strengthened overall understanding of the ozone layer and its effect on ultraviolet (UV) radiation, and the effect of UV radiation on terrestrial and aquatic ecosystems and on human health. These advances are highlighted in the enclosed reports that describe the current understanding of the impact of human activities and natural phenomena on the ozone layer and the environmental effects of ozone depletion.

VI. Impacts on U.S. Greenhouse Gas Emissions

U.S. actions under the current Montreal Protocol and Clean Air Act requirements have also helped protect against climate change. The cumulative emission reduction associated with the phase-out of U.S. production and import of ozone-depleting substances from 1987 to 2005 is estimated to be more than 10 million metric tonnes (not weighted by the ozone depletion potential of the various substances). Given that many ozone-depleting substances are also potent greenhouse gases, this cumulative emission reduction is equivalent to a reduction of approximately 13,000 million CO2-equivalent metric tons. Annualized, it is equivalent to approximately 1,500 million CO2-equivalent metric tons per year which would be equal to all GHG emissions from US passenger cars and trucks for approximately seven years.

Many ozone depleting substances are extremely potent greenhouse gases (GHG) as they have high radiative forcing properties and persist in the environment for decades or centuries. In fact, many ozone depleting substances are 1,000 to 10,000 times more potent greenhouse gases than carbon dioxide (CO_2). Global warming potential (GWP), which estimates the radiative forcing of a chemical over a 100 year time horizon, is the metric most commonly used by EPA and the international community to estimate the impact of various gases on global warming relative to carbon dioxide. Three of the most highly consumed CFCs in the 1980s and early 1990s were CFC-11, CFC-12, and CFC-113 which have GWPs of 4600, 10600, and 6000 respectively.[2] CO_2-equivalent metric tons is a measure employed to compare the impact of various gases on climate change, and is derived by multiplying the metric tons of a particular gas by its associated GWP.

Ozone depleting substances are excluded from the United Nations Framework Convention on Climate Change and the Kyoto Protocol because they are already regulated under the Montreal Protocol. Nonetheless, the near elimination of class I ozone depleting substances has had an important effect on overall U.S. emissions of greenhouse gases.

VII. Conclusion

Title VI of the Clean Air Act Amendments of 1990 requires EPA to create a regulatory program to protect the stratospheric ozone layer to, in part, meet the requirements of the Montreal Protocol. Domestic rules and programs implemented by EPA are ensuring the success of the phaseout of ozone-depleting substances and discovery of alternatives. The phase out has resulted in a dramatic decrease in the production, use, and consumption of ozone-depleting substances. In the United States, production and consumption of class I ozone-depleting substances are virtually at zero, with only very limited amounts that are permitted as exemptions under the Protocol. EPA expects to continue progress in identifying alternatives for several key uses, and further progress in phasing out the class II ozone-depleting HCFCs. Models predict that progress is being made to heal the ozone layer as a result of actions taken under the Montreal Protocol and regulations promulgated under the CAA. [b]

VIII. Sources

1. World Meteorological Organization (WMO) Global Ozone Research and Monitoring Project. *Scientific Assessment of Ozone Depletion: 2006*. Geneva, Switzerland.

[b] World Meteorological Organization (WMO) Global Ozone Research and Monitoring Project. *Scientific Assessment of Ozone Depletion: 2006*. Geneva, Switzerland.

2. World Meteorological Organization (WMO) Global Ozone Research and Monitoring Project. *Environmental Effects of Ozone Depletion and its Interactions with Climate Change: 2006 Assessment.* Geneva, Switzerland.
3. United Nations Environment Programme (UNEP). *2006 Assessment Report of the Technology and Economic Assessment Panel.*
4. Intergovernmental Panel on Climate Change (IPCC) *Third Annual Report: Climate Change: 2001.* Geneva, Switzerland

SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2006

Executive Summary

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Published in March 2007

ISBN: 978-92-807-2757-9
OZO/0873/NA

Copies of this publication are available from:

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This report can be viewed on the World Wide Web at the following locations:
http://www.wmo.ch/web/arep/ozone.html
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Citation information:
Executive Summary: Scientific Assessment of Ozone Depletion: 2006, 39 pp., World Meteorological Organization, Geneva, Switzerland, 2007. [Reprinted from *Scientific Assessment of Ozone Depletion: 2006*, Global Ozone Research and Monitoring Project—Report No. 50, 572 pp., World Meteorological Organization, Geneva, Switzerland, 2007.]

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Cover: Artistic rendering of the evolution of total chlorine in the midlatitude stratosphere, 1975-2006. Warmer colors show higher amounts of total chlorine. Derived from Figure 1-10 (updated from Engel et al., 2002) of Chapter 1, Scientific Assessment of Ozone Depletion: 2006. Cover design layout by Debra Dailey-Fisher (NOAA Earth System Research Laboratory).

UNITED NATIONS
ENVIRONMENT PROGRAMME

UNEP

ENVIRONMENTAL EFFECTS OF OZONE DEPLETION AND ITS INTERACTIONS WITH CLIMATE CHANGE: 2006 ASSESSMENT

Pursuant to Article 6 of the Montreal Protocol on Substances that Deplete the Ozone Layer under the Auspices of the United Nations Environment Programme (UNEP).

Copies of the report are available from
United Nations Environment Programme (UNEP)
P. O. Box 30552
Nairobi , Kenya

Published December 2006 by the Secretariat for The Vienna Convention for the Protection of the Ozone Layer and The Montreal Protocol on Substances that Deplete the Ozone Layer United Nations Environment Programme (UNEP)

United Nations Environment Programme (UNEP), P. O. Box 30552, Nairobi, Kenya

UNEP, Environmental Effects of Ozone Depletion: 2006
Assessment, United Nations Environment Programme

ISBN: 978-92-807-2821-7
Job No: OZO/0947/NA

ENVIRONMENTAL EFFECTS OF OZONE DEPLETION AND ITS INTERACTIONS WITH CLIMATE CHANGE: 2006 ASSESSMENT

Introduction

This assessment was prepared by the Environmental Effects Assessment Panel for the Parties to the Montreal Protocol. The assessment reports on some of the new findings since the last full assessment of 2002, again paying attention to the interactions between ozone depletion and climate change and their consequences for environmental and health issues. Simultaneous publication of the assessment in the scientific literature aims to show the scientific community how their data, modeling, and interpretations are playing a role in information dissemination to the Parties to the Montreal Protocol and other policy makers. It is also hoped that the publication will stimulate the scientific community to continue working on the gaps in knowledge that still exist.

The 2006 assessment will be published in the Journal Photochemical & Photobiological Sciences, 2007.

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LIST OF ABBREVIATIONS

1,25(OH)2D	1,25-dihydroxyvitamin d
25(OH)D	25-hydroxyvitamin d
AK	Actinic keratosis
AO	Arctic Oscillation. A large-scale variation in Arctic wind patterns
APase	Alkaline phosphatase
APC	Antigen presenting cell
ASL	Above sea level
BCC	Basal cell carcinoma (s)
Br	Bromine (an ozone depleting chemical)
BrO	Bromine monoxide
BSWF	Biological spectral weighting functions
BWF	Biological weighting function
CAS	Chemical Abstracts Service
CC	Cortical cataract(s)
CDFA	Chlorodifluoroacetic acid
CDK	Climatic droplet keratopathy
CDOC	Colored dissolved organic carbon
CDOM	Colored (or chromophoric) dissolved organic matter
CPD	Cyclobutane pyrimidine dimmer
CFC	Chlorofluorocarbon. Ozone-damaging chemical (e.g., $CFCl_2$: dichlorodifluoromethane. CCl_2F_2), now controlled under the Montreal Protocol
CH	Contact hypersensitivity
CH_4	Methane (a greenhouse gas)
CIE	Commission Internationale de l'Eclairage (International Commission on Illumination)
Cl	Chlorine (an ozone depleting chemical)
CM	Cutaneous melanoma
CO	Carbon monoxide

CO_2	Carbon dioxide (a greenhouse gas)
COS	carbonyl sulfide
CPD	Cyclobutane pyrimidine dimer
Cu	Copper (Cu(I) and Cu(II) being different oxidation states)
DIC	Dissolved inorganic carbon
DMS	Dimethylsulfide
DMSP	Dimethylsulfoniopropionate
DNA	Deoxyribonucleic acid
DOC	Dissolved organic carbon
DOM	Dissolved organic matter
DON	Dissolved organic nitrogen
DSB	Double strand break
DTH	Delayed type hypersensitivity
DU	Dobson Unit (used for the measurement of total column ozone (1 DU=2.69 × 1016 molecule cm^{-2})
EAE	Experimental allergic encephalitis
EDUCE	European Database for Ultraviolet Radiation Climatology and Evaluation
EESC	Equivalent Effective Stratospheric Chlorine
ENSO	El Niño Southern Oscillation. A large-scale climate variability in the Pacific region
EP	Earth Probe (a NASA satellite)
EPA	Environmental Protection Agency
EV	Epidermodysplasia verruciformis
Fe	Iron (Fe(II) and Fe(III) being different oxidation states)
FMI	Finnish Meteorological Institute
GHG	Greenhouse gas
Glu I	A pathogenesis-related (PR) protein
HALS	Hindered Amine Light Stabilizer
HCFC	Hydrochlorofluorocarbon. Interim replacements for CFCs with small ozone depletion potential (e.g., R22: chlorodifluoromethane $CHClF_2$) to be phased out

HFC	Hydrofluorocarbon. Long-term replacements for CFCs, with zero ozone depletion potential
Hg	Mercury (Hg0aq and Hg(II) being different oxidation states)
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
HSV	Herpes simplex virus
HY5	Transcription factor HY5, which is a key downstream effector of the UVR8 (UV-regulatory protein) pathway
IBD	Inflammatory bowel disease
IL	Interleukin
Ink4a	Murine inhibitor of kinase 4a protein (gene in italics)
IPCC	Intergovernmental Panel on Climate Change
IPF	Immune protection factor
kda	Kilodalton
KNMI	Dutch National Institute for Weather, Climate and Seismology (The Netherlands)
L·	Lipid radical
MAA	Mycosporine-like amino acids
Mb	Megabase, equal to 1 million base pairs
MC1R	Melanocortin 1 receptor
MHC	Major histocompatibility complex
MS	Multiple sclerosis
N_2O	Nitrous oxide (a greenhouse gas that is also a source of NO_2)
NAO	North Atlantic Oscillation. A large-scale variation and redistribution of atmospheric mass in the Atlantic region producing large changes in the NH dynamics
NASA	National Aeronautic and Space Administration (USA)
NaTFA	Sodium trifluoroacetate
NC	Nuclear cataract(s)
NCAR	National Centre for Atmospheric Research, USA
NH	Northern Hemisphere.

NIMBUS-7	A NASA satellite
NIVR	Netherlands Agency for Aerospace Programmes
NMHCs	Non-methane hydrocarbons
NMSC	Non-melanoma skin cancer
NO	Nitric oxide (an ozone depleting gas)
NO_2	Nitrogen dioxide (an ozone depleting gas)
NOAA	National Oceanic and Atmospheric Administration, USA
NOEC	No observed effect concentration
NOx	Nitrogen oxides
O_3	Ozone
OCS	Carbonyl sulfide (also COS)
ODS	Ozone depleting substance(s)
·OH	Hydroxyl radical (and important atmospheric cleaning agent)
OMI	Ozone Monitoring Instrument (on board the Aura satellite)
OTR	Organ transplant recipients
P	Phosphorous
PAH	Polycyclic aromatic hydrocarbon(s)
PAM	Pulse amplitude modulated (fluorescence)
PAR	Photosynthetically active radiation, 400-700 nm waveband
PAUR II	Photochemical Activity and solar Ultraviolet Radiation campaign 2
pCO_2	Partial pressure of carbon dioxide
PEC	Predicted environmental concentration
Pg	Peta gram (1x1012 grams)
PHR1	The gene encoding CPD photolyase
PNEC	Predicted no effect concentration
POC	Particulate organic carbon
POM	Particulate organic matter
PR	Pathogenesis-related proteins
PSC	Posterior subcapsular cataract(s)

PSC	Polar stratospheric cloud (ice crystals which form at high altitudes in Polar regions when the temperature is below a critical threshold)
Ptc	Murine patch protein (gene in italics)
PTCH	Human patch protein (gene in italics)
QBO	Quasi biennial oscillation (a shift in wind patterns - especially over the tropics - with a period of approximately 2.2 years)
RA	Rheumatoid arthritis
RAF	Radiation amplification factor (a measure of sensitivity to ozone change)
ROS	Reactive oxygen species (·OH, for example)
RT	Radiative transfer
SAGE	Stratospheric Aerosol and Gas Experiment, a satellite-based instrument
SCC	Squamous cell carcinoma
SCC	Squamous cell carcinoma
SH	Southern Hemisphere
SZA	Solar zenith angle (i.e. the angle between zenith and the centre of the solar disk)
TFA	Trifluoroacetic acid
Th1	T-helper 1
Th2	T-helper 2
TOMS	Total Ozone Mapping Spectrometer, a satellite-based instrument
Treg cell	T-regulatory cell
Troposphere	Lowest part of the earth's atmosphere (0-16 km)
UCA	Urocanic acid
UV	Ultraviolet. Wavelengths from 100 nm to 400 nm. Ozone and other atmospheric gases progressively absorb more and more of the radiation at wavelengths less than 320 nm. Only those greater than 290 nm are transmitted to the Earth's surface
UV index	A standardised unit for providing UV information to the public
UV-A	Electromagnetic radiation of wavelengths in the 315 to 400 nm range
UV-B	Wavelength range 280-315 nm, as defined by CIE
UV-B	Electromagnetic radiation of wavelengths in the 280 to 315 nm range
UV-C	Electromagnetic radiation of wavelengths in the 100 to 280 nm range

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UVEry	Erythemally-weighted UV irradiance, where the irradiance is weighted by the erythemal action spectrum.
UVI	A standard scale for reporting UV irradiance to the public. The UVI is a unitless number which is 40 times the erythemally-weighted irradiance, measured in units of W m^{-2}.
UVR	Ultraviolet radiation
UVR8	UV-regulatory protein
VDR	Vitamin d receptor
VOC	Volatile organic compound (s)
WMO	World Meteorological Organization
WOUDC	World Ozone and UV Data Centre
XP	Xeroderma pigmentosum

Environmental Effects of Ozone Depletion: 2006 Assessment

Interactions of Ozone Depletion and Climate Change

Executive Summary

Ozone and UV Changes

- **The Montreal Protocol is working. The concentrations of ozone depleting substances in the atmosphere are now decreasing.** Outside Polar Regions, the decline of ozone seen in the 1980s and 1990s has not continued. In Polar Regions, there is much higher variability. Each spring, large ozone holes continue to develop in Antarctica and less severe regions of depleted ozone continue to develop in the Arctic. There is evidence that some of these changes are driven by changes in atmospheric circulation rather than being solely attributable to reductions in ozone-depleting substances, which may indicate a linkage to climate change. Global ozone is still less than in the 1970s. Changes in ozone directly influence UV-B radiation, so elevated UV-B radiation due to reduced ozone is expected to continue.

- **The future evolution of atmospheric ozone remains uncertain. It is expected to increase slowly in the decades ahead, but it is not known whether it will return to higher, similar, or lower levels than those prior to the onset of ozone depletion.** Current chemical models are unable to reproduce accurately all of the observed ozone variability, the rates of future increases in greenhouse gases are not yet established, and interactions between ozone depletion and climate change are not yet fully understood. Current models predict that ozone will have recovered from the effects of man-made ozone-depleting gases by mid-century at mid-latitudes, and about 1-2 decades later at polar latitudes.

- **Long term responses in UV-B radiation caused by ozone changes have been observed.** Increases in UV-B irradiance have occurred over the period of ozone depletion. At unpolluted sites in the Southern Hemisphere, there is some evidence that UV-B irradiance has diminished since the late 1990s. Because of improvements in the availability and temporal extent of UV data we are now able to evaluate the changes in recent times compared with those estimated since the late 1920s, when ozone measurements first became available. The increases in UV-B radiation from about 1980 to the end of the 20th century have been larger than the long-term natural variability.

- **The effects of aerosols and air pollutants on long-term variations in UV-B irradiance may be comparable with those due to changes in ozone.** At some sites in the Northern Hemisphere, UV-B radiation may continue increasing because of the continuing reductions in the attenuation by aerosols since the 1990s despite the cessation of ozone depletion.

- **Interactions between ozone depletion and climate change are complex and can be mediated through changes in chemistry, radiation, and atmospheric circulation patterns.** The changes are in both directions: ozone changes affect climate, and climate changes affect ozone. Contrary to what was predicted from some models in previous assessments, more recent models and the observational evidence suggest that stratospheric ozone (and therefore UV-B radiation) has responded relatively quickly to changes in ozone depleting substances, implying that climate interactions have not delayed these responses.

- **There is greater uncertainty about future surface UV-B radiation than future ozone, since UV-B radiation will be additionally influenced by climate change.** Climate change can also affect UV-B radiation through changes in cloudiness, aerosols and surface reflectivity, without involving ozone. The rate of climate change is accelerating. Temperature changes over the 21st century are likely to be about 5 times greater than in the past century. This will affect future cloud, aerosol and surface reflectivity. Consequently, unless strong mitigation measures are undertaken with respect to climate change, profound effects on the biosphere and on the solar UV radiation received at the Earth's surface can be anticipated.

Health

- **In addition to cortical cataract, nuclear cataract has been found to be associated with polar UV radiation.** Numerous studies have implicated exposure to solar UV radiation as a causative factor in the development of cortical cataract. Several reports now confirm an association between nuclear cataract and UV exposure. In addition, higher ambient temperatures may increase the risk of nuclear cataract development. In contrast, there is insufficient evidence to infer a causative role for solar UV radiation in the induction of posterior subcapsular cataract.

- **Exposure to sunlight is a significant risk factor for pterygium on the surface of the eye.** Pterygium is an inflammatory, proliferative and invasive lesion of the human cornea that can severely impair vision. It is induced, in part, by the intracellular damage caused by UV-B exposure. Genetic factors and the degree of long-term exposure to sunlight are important parameters for the development of pterygia in populations of all skin colours.

- **Adverse photobiological effects of UV radiation on the eye can be enhanced by the presence of clouds and are thus affected by climate change.** Although direct sunlight does not play a major role in acute solar photokeratitis, sunburn of the eye, or in cataract formation, scattered and reflected UV-B radiation contribute to these disorders. Under conditions of cloud cover and with lower light levels, the natural defence mechanisms of the eye are relaxed, permitting greater exposure of the anterior surface of the eye and its internal structures. At the same time, the effective UV-B exposure of the eye can be increased during cloud cover due to scatter.

- **The incidence of squamous cell carcinoma (SCC), basal cell carcinoma (BCC) and melanoma continues to rise.** Approximate doublings in the incidence of all three types of skin cancer have been projected in the Netherlands for the years 2000 to 2015 and in many other countries with predominantly fair-skinned populations. The major increase in melanoma incidence has been for thin (early) melanomas that have high survival rates. In children, the incidence of melanoma is still rising and has been positively correlated with environmental UV radiation exposure.

- **Susceptibility to skin cancer is increasingly recognised as being linked with subtle variations in genes that code for proteins involved in prevention and repair of DNA**

damage. Such proteins function in defensive mechanisms that are crucial to the prevention of skin cancers. The relevance of certain gene variations differ between skin cancer types and these variations provide clues regarding the types of DNA damage and repair that are important in each of the skin cancer types. Thus, there is a wide range in the occult genetically determined susceptibility in a population. In the future, gene profiling may accurately identify high-risk individuals.

- **UV-induced immunosuppression is a crucial factor in the generation of skin cancers. In some subjects, this immunomodulation may lead to viral reactivation and a reduction in vaccine efficacy.** The lack of repair of UV-induced DNA changes decreases the resistance to skin cancers and is a significant factor in the generation of such tumours. By effects both on the virus itself and on suppression of immunity, solar UVR exposure can induce the reactivation of latent herpes simplex virus leading to the re-emergence of cold sores. The virus is a co-factor in the development of some skin cancers and conjunctival squamous cell carcinomas in association with human papillomavirus infection. Limited evidence indicates that UV radiation exposure can reduce the efficacy of vaccination, at least in genetically predisposed individuals.

- **Vitamin D, formed by exposure of the skin to UV-B (with subsequent hydroxylation to the active vitamin), may play a protective role against the development of several internal cancers, autoimmune and some other diseases.** A number of studies link low solar UV exposure with a higher risk of some internal cancers, such as colorectal and prostate, and autoimmune disease, such as multiple sclerosis and type 1 diabetes. As lack of exposure to the UV-B in sunlight leads to suboptimal vitamin D levels, vitamin D has been proposed as the protective factor in helping to prevent these diseases. The evidence to support the protective role of solar UV-B exposure and whether this is mediated through vitamin D is not definitive.

- **Personal strategies to protect the eye and skin from the adverse effects of high solar UVR exposure are being adopted increasingly by the general public.** Health campaigns in several countries such as Australia, Canada, UK, and USA have raised the awareness of the general public regarding protection from the sun. Broad-spectrum sunscreens, in widespread use in mid-latitudes by fair-skinned individuals, minimise the erythemal effects of high sun exposure. UV-absorbing soft contact lenses covering the entire cornea provide excellent protection from solar UV-B for the eye, and are superior to some tinted sunglasses as the soft contact lenses shield against UV radiation entering from the side or below.

- **It is not feasible to give a single recommendation for optimal solar UV-B exposure to allow sufficient vitamin D synthesis while not increasing the risk of skin cancer.** The solar UV-B dose experienced by an individual varies greatly depending on time of the day, latitude, altitude, season of the year, cloud cover, activity and type of clothing worn. Skin colour, age and genetic background are other critical factors in determining the positive or negative outcome of the exposure. Therefore the message regarding "safe" sun exposure depends on the individual and place of residence.

- **The interaction between ozone depletion and global climate change may adversely affect human health.** At present, it is impossible to predict how global warming might alter the behaviour of people, especially those living in mid-latitudes, with respect to the amount of time spent outdoors in sunlight. If temperatures rise, then personal solar UV radiation exposure might be greater than at present. This would then have detrimental effects on the incidence of skin cancer and cataract and on the immune system, although benefiting vitamin D status.

Terrestrial Ecosystems

- **Field studies, in which solar UV-B radiation is either augmented or attenuated, report many effects on higher plants and on bacteria, fungi and other microbes.** Although photosynthesis of higher plants and mosses is seldom affected in field studies by UV-B radiation, growth and morphology (form) of higher plants and mosses are often changed. This can lead to small reductions in shoot growth and changes in the competitive balance among species. Fungi and bacteria are generally more sensitive to damage by UV-B radiation than are higher plants. However, the species differ in their UV-B sensitivity to damage. This can lead to changes in species composition of microbial communities with subsequent influences on processes such as litter decomposition. Changes in plant chemical composition are commonly reported from experiments using enhancement or attenuation of UV-B radiation in sunlight.

- **Enhanced UV-B often leads to substantial reductions in consumption of plant tissues by insects.** In some cases this is because of altered insect behaviour, but changes in plant chemical and physical characteristics induced by UV-B radiation usually account for the reduced herbivory. Such modifications affect many interactions of plants with other organisms, both above and below ground. More is now understood about the mechanisms of these interactions.

- **Although sunlight does not penetrate significantly into soils, the biomass and morphology of plant root systems can be affected to a much greater degree than plant shoots.** Root mass can exhibit large declines with enhanced UV-B radiation. Also, UV-B-induced changes in soil microbial communities and biomass, as well as altered populations of small invertebrates have been reported and these changes have important implications for processing of mineral nutrients in the soil. Many of these ecosystem-level phenomena appear to be the result of systemic changes in chemical and physical properties of plants and in the nature of root exudates.

- **UV-B radiation and other environmental factors that are undergoing changes such as temperature, CO_2, moisture and available nitrogen over large areas may interact to produce a complex plant response.** In several studies, plant growth was augmented by higher CO2 levels, while on the other hand many of the effects of UV-B radiation were usually not ameliorated by the elevated CO_2. UV-B radiation often increases both plant frost tolerance and survival under extreme high temperature conditions. Conversely, extreme temperatures sometimes influence the UV-B sensitivity of plants. Plants that are drought tolerant are likely to be more tolerant of high UV-B flux. Furthermore, UV-B radiation has been reported to alleviate some symptoms of water stress. Biologically available nitrogen is exceeding historical levels in many regions due to human activities. Studies show that plants well supplied with nitrogen are generally more sensitive to UV-B radiation.

- **Many new developments in understanding the underlying mechanisms mediating plant response to UV-B radiation have emerged.** UV-B radiation results in an activation of as yet uncharacterised receptor molecules. These initial events engage signalling pathways that result in altered plant gene expression and response. Exposure to UV-B induces some signals that are UV-B-specific and some that have elements in common with those elicited by other environmental factors. The use of shared signalling elements generates overlapping patterns of gene expression and functional responses. This new information is helpful in understanding common responses of plants to UV-B radiation, such as diminished growth, acclimation to elevated UV radiation, and interactions of plants with plant consumer organisms. It also helps in interpreting the interaction of various environmental stresses on plant growth and function.

- **Technical issues concerning the use of biological spectral weighting functions (BSWFs) have been further elucidated.** The BSWFs are multiplication factors assigned to different wavelengths giving an indication of their relative biological effectiveness. They are critical to the proper conduct and interpretation of experiments in which organisms are exposed to UV radiation, both in the field and in controlled environment facilities. The characteristics of BSWFs vary considerably among different plant processes, such as growth, DNA damage, oxidative damage and induction of changes in secondary chemicals. Thus, use of a single BSWF for plant or ecosystem responses is not appropriate.

Aquatic Ecosystems

- **Recent field studies continue to show that even current solar UV-B radiation can adversely affect aquatic organisms.** Reductions in productivity and impaired reproduction and development have been shown for phytoplankton, fish eggs and larvae, zooplankton and other primary and secondary consumers exposed to UV-B radiation. UV-B-related decreases in biomass productivity can be transferred through all levels of the food web, as well as cause changes in species composition and structure and function of ecosystems. Decreases in primary production would result in reduced sink capacity for atmospheric carbon dioxide, with its related effect on climate change.

- **Experiments in large enclosures show that changes in community structure may be more ecologically important than effects of enhanced UV-B on overall algal biomass.** These mesocosm experiments allow the experimenter to control the level of UV radiation on plankton communities to simulate various levels of ozone depletion. Growth was inhibited by ambient UV radiation in fixed-depth experiments but not in mesocosms where vertical mixing exposed planktonic organisms to variable radiation regimes. A synthesis model simulating mesocosm experiments suggests that enhanced UV-B could cause a shift from primary producers to bacteria at the community level. Shifts in community structure could have important consequences for carbon dioxide concentration in oceanic surface waters.

- **Recent studies have expanded our understanding of UV-B protection mechanisms for aquatic organisms.** UV radiation impairs photosynthesis, nitrogen fixation and damage DNA, but most phytoplankton have developed mitigating measures including UV-absorbing substances, repair enzymes and reactive oxygen species scavenging systems. However, protection is not complete. Picoplankton cyanobacteria do not produce absorbing substances but rely on fast cell division; these organisms have recently been found to be ubiquitous and to contribute more than 50 % to the productivity in aquatic habitats. Solar UV controls the vertical position of macroalgae in the tidal zone. Organisms in the upper tidal zone have developed effective screening and repair mechanisms.

- **UV-B-related decreases in primary-producer biomass have a negative effect on the growth and survival of consumers, which form the higher levels in the aquatic food web.** Specific, direct UV B effects have been identified in a wide variety of consumers, including copepods and other zooplankton, corals and sea urchins.

- **In their natural habitat, zooplankton face conflicting selection pressures, including exposure to UV-B radiation and factors of global climate change.** Invertebrate predators cause an upward movement of the zooplankton during daylight hours, exposing them to high levels of UV radiation at the surface. Besides vertical migration and UV screening, zooplankton rely on photorepair of UV-B-induced DNA damage. Increases in water temperature resulting from climate change are expected to increase enzymatic activity, which would enhance photorepair.

- **Primary causes for a decline in fish populations are predation and poor food supply for larvae; however, exposure of the larvae to enhanced UV-B radiation may further contribute to this decline.** Other major factors are overfishing, increased water temperature due to global climate change, pollution, and disease. Imprecisely defined habitat characteristics and the naturally high mortality rates of fish larvae render quantitative assessment of specific UV-B effects difficult.

- **The concentration and chemical composition of dissolved organic matter in aquatic ecosystems govern the penetration of UV radiation in the water column.** UV radiation affects the species composition of plankton communities and thus the concentration of DOM. There is a strong link between early succession of zooplankton communities and terrestrial plant communities within watersheds, which in turn are affected by climate change. Consequently, climate change and UV radiation have the potential to affect species composition in lakes and also to increase the invasion potential by imported species.

Biogeochemical Cycles

- **Climate-related changes can alter the transfer of organic matter from terrestrial to freshwater and coastal ecosystems and thereby influence UV radiation penetration into water bodies, with major consequences for aquatic biogeochemical processes.** These changes are particularly prevalent in high latitude systems. Dissolved organic matter leaching from or running off terrestrial ecosystems enters streams, rivers, lakes and, ultimately the oceans. The coloured part of dissolved organic matter controls the penetration of UV radiation into water bodies, but is also photodegraded by solar UV to release small inorganic molecules, mainly CO_2.

- **Future increases in the temperature of surface waters will enhance stratification of lakes and the ocean, which will intensify effects of UV-B radiation on biogeochemistry in the surface layer.** This important effect is manifested by the extensive increase in transparency of the water to UV-B radiation in the upper layer of stratified aquatic environments. These effects of climate change increase the impacts of UV-B radiation on biogeochemical cycles in the upper layer of aquatic systems, thus partially offsetting the beneficial effects of an ozone recovery.

- **Climate change and changes in UV-B radiation influence the concentration of halogen-containing compounds that are involved in ozone chemistry in the atmosphere.** Emissions of halogen-containing compounds, for example, methyl bromide from higher plants, increase with increasing air temperature. Recent observations indicate that methyl bromide concentrations in the atmosphere are decreasing at a rate of 2.5 – 3.0 % per year but future global warming may reduce the current rate of decline. Bromine and other halogen radicals are also generated in UV-B radiation induced reactions of halogen-containing compounds both in atmospheric aerosols present in the marine boundary layer and in surface waters. These halogen-containing compounds may be transported by convection to the upper troposphere where the bromine radical participates in ozone destruction.

- **UV-B can alter the biological availability and toxicity of metals in aquatic environments.** Although many trace metals are essential trace nutrients, all metals are toxic above a certain concentration. In sunlit surface waters, however, they often exist in forms that are biologically not available. Increased UV-B can alter the chemical form of metals to produce forms that are available to aquatic organisms. For example, the UV-induced oxidation of elemental mercury results in the formation of precursors to methyl mercury that can adversely affect human health through bioaccumulation in aquatic food webs.

- **UV radiation drives photoreactions involved in cycling of marine sulphur, leading to the production of atmospheric aerosols and cloud formation.** Oceanic emissions of dimethylsulphide (DMS) produce atmospheric aerosols that influence atmospheric radiation and temperature. UV radiation induced transformation is an important sink of DMS in the upper ocean. Carbonyl sulphide, another important sulphur compound in the upper ocean, is produced in UV-B radiation induced reactions involving chromophoric DOM.

- **In terrestrial systems UV-B radiation can affect cycling of carbon and nutrients through changes in decomposition and soil biology.** Exposure to solar UV-B radiation causes direct photodegradation of dead plant material, especially in arid climates. When plants are exposed to UV-B radiation, changes in plant root exudation and/or the chemistry of dead plant material influence soil organisms and biogeochemistry. Changes in carbon and nutrient cycling induced by UV-B radiation can interact with responses to climate change and so may influence long-term ecosystem carbon budgets.

Air Quality

- **Models and measurements suggest that ozone transport from the stratosphere to the troposphere may have decreased by approximately 30% in the last 30 years.** Ozone concentrations near the ground are a key indicator of air quality. Tropospheric ozone concentrations are affected by UV-B radiation, local weather systems, and pollutant concentrations. Stratospheric ozone depletion has increased the rate of ozone production in the troposphere due to enhanced UV-B radiation but reduced the amount of ozone transported from the stratosphere to the troposphere.

- **The predicted future increase in stratospheric ozone may increase tropospheric temperature and concentrations of ozone in the atmospheric boundary layer.** Models predict that ozone concentrations in the atmospheric boundary layer will increase globally by 33 to 100% during the period 2000 to 2100 due to the combined effects of climate change, atmospheric pollution, and increases in stratospheric ozone. The impact of this increase on climate is difficult to quantify as tropospheric ozone concentrations are very variable, both in space and time.

- **Changes in the concentration of tropospheric hydroxyl radical caused by changes in UV-B radiation are now much better quantified.** Tropospheric hydroxyl radical (OH) is one of the major oxidizing agents in the atmosphere, destroying trace gases that are involved in ozone depletion, climate change, and urban air pollution. The globally averaged OH has been observed to change on short time scales (months – years) but not in the longer term. Recent measurements in a relatively clean location over 5 years showed that OH concentrations can be predicted by the intensity of solar ultraviolet radiation. If this relationship is confirmed by further observations, this approach could be used to characterize the oxidation efficiency of the troposphere in different chemical regimes using UV radiation measurements, thus simplifying assessment of air quality.

- **Confidence in models estimating the impact of ozone change on the oxidation capacity of the atmosphere has improved for unpolluted locations.** Measurements of UV radiation and chemical composition, including OH in the lower atmosphere, now normally agree with chemical models to within the measurement accuracy in unpolluted air both for clear skies and uniform cloud cover. However, in moderately and heavily polluted urban regions or forested environments, models and measurements disagree. These model uncertainties underline the importance of local measurements of tropospheric ozone, especially in areas where air may be polluted.

- **An analysis of surface-level ozone measurements in Antarctica suggests that there has been a significant change in the chemistry of the atmospheric boundary layer in this region as a result of stratospheric ozone depletion.** Measurements of ozone concentrations in the atmospheric boundary layer show a recent (since 1990) increase in surface ozone concentrations consistent with more UV radiation reaching the earth's surface during ozone hole episodes, and the enhanced production of nitrogen oxides from the ice. Thus, the Antarctic lower atmosphere is estimated to be more oxidizing now than before the development of the ozone hole, which may have adverse consequences through changing bioavailability of metals.

- **The tropospheric concentration of HFC-134a, a potent greenhouse gas and the main known anthropogenic source of trifluoroacetic acid, is increasing rapidly.** The increase is in agreement with the known usage and atmospheric loss processes. Observations in both hemispheres between 1998 and 2002 show that the concentration of HFC-134a has been increasing by up to 12% per year. The good agreement between observations and known sources and sinks gives increased confidence in predictions of the environmental build-up of trifluoroacetic acid. The increasing concentration of HFC-134a may contribute to an acceleration of climate change.

- **Risks to humans and the environment from substances produced by atmospheric degradation of hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) are considered minimal.** These include trifluoroacetic acid (TFA) and chlorodifluoroacetic acid. Recent studies reinforce the conclusion of small environmental and human health risks from current environmental loadings in fresh- and salt-water. Although the amounts of these compounds are expected to continue to increase in the future because of climate change and continued use of HCFCs and HFCs, current information suggests that this is not an issue of great importance.

- **Perfluoropolyethers, substances proposed as HCFC substitutes, have very large global warming potential and show great stability to chemical degradation in the atmosphere.** These compounds are commonly used as industrial heat transfer fluids. It is not known whether these substances will contribute significantly to global warming and its interaction with ozone depletion. Their risks should be further evaluated.

Materials Damage

- **Plastics and wood exposed to solar UV radiation undergo degradation losing their useful properties over a period of time.** This damage is dose-dependent and limits the outdoor lifetimes of most materials. The damage is exacerbated by higher ambient temperatures, higher humidity levels, and atmospheric pollutants. Light stabilizers and surface coatings are generally used to control the solar-UV induced damage to materials. Higher UV levels will require higher levels of stabilizers resulting in higher cost of materials used outdoors.

- **Several novel UV stabilizers and product fabrication techniques that improve UV-resistance have been reported.** New variants of effective light stabilizers, such as stabilizer compounds that bind to the polymer and are therefore less likely to be lost by leaching, have been reported recently. Mechanisms of synergistic effects of stabilizer blends have been further elucidated and will contribute to the design of new light-stabilizer blends. Continued research on this topic will facilitate the development of strategies that are better able to protect materials exposed to solar UV-B radiation.

- **An emerging trend towards the use of nanoscale fillers may improve the UV stability of plastics formulations.** These nanoscale fillers have smaller average particle sizes and often yield better mechanical properties than conventional fillers. Initial data suggest some of the nanoscale fillers may also act as good light stabilizers and extend the service life of products exposed to outdoor UV radiation. However, potential interference of these fillers with the effects of conventional light stabilizers or other additives such as antioxidants or flame retardants has not yet been fully evaluated.

- **Using powdered wood as a filler in plastics is continuing to be explored, and the effect of these fillers on UV-stability depends on the type of wood.** Powdered wood and other plant materials are used as low-cost natural fillers in some plastics products intended for outdoor use. Recent research indicates that several of these plant-derived fillers can either enhance the photodamage or act as a photostabilizer for the plastic material, depending on the source of the natural filler material and processing method used with the material. However, the lignin content in wood filler absorbs solar UV-B radiation and promotes photodamage of the polymer component. Identifying sources and processing technologies for these bio-based fillers without compromising light stability of filled polymers can lead to low-cost UV-stable plastics products for certain outdoor applications.

MONTREAL PROTOCOL

ON SUBSTANCES THAT DEPLETE

THE OZONE LAYER

UNEP

2006 ASSESSMENT REPORT OF THE
TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

Montreal Protocol
On Substances that Deplete the Ozone Layer

UNEP
2006 Assessment Report of the Technology and Economic Assessment Panel

The text of this report is composed in Times New Roman.

Co-ordination: **Technology and Economic Assessment Panel**

Reproduction: UNEP Nairobi, Ozone Secretariat
Date: March 2007

Printed copies of this report are available from:

SMI Distribution Service Ltd., Stevenage, Hertfordshire, UK,
fax: + 44 1438 748844

This document is also available in portable document format from

http://www.unep.org/ozone

ISBN: 92-

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Acknowledgement

The Technology and Economic Assessment Panel, its Technical and Economic Options Committees and the Task Forces Co-chairs and members acknowledges with thanks the outstanding contributions from all of the individuals and organisations who provided support to the Panel and the Technical Options Committees. The opinions expressed are those of the Panel, the Committees and Task Forces and do not necessarily reflect the reviews of any sponsoring or supporting organisation.

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2006 Assessment Report
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Technology and Economic Assessment Panel

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1 Executive Summary

Since the 2002 Assessment of the Technology and Economic Assessment Panel (TEAP), a large number of technical developments have taken place. The direction many of these developments have taken could not have been predicted in 2002. The Panel's Technical Options Committees, on Chemicals (CTOC), on Foams (FTOC), on Halons (HTOC), on Methyl Bromide (MBTOC), on Medical Uses (MTOC) and on Refrigeration and AC (RTOC) have each issued a 2006 Assessment Report that document these developments. The Executive Summaries of these reports form the body of the 2006 TEAP Assessment Report and their Abstract Executive Summaries, with the summaries of other chapters, form the Executive Summary of the 2006 TEAP Assessment Report."

During the year 2006, one Task Force under the TEAP has reported their findings, which were published in October 2006, shortly before the Meeting of the Parties in Delhi. In particular the findings of this Task Force on Emissions Discrepancies (TFED) are interlinked with the findings reported earlier in the IPCC TEAP Special Report and the Supplement to the Special Report by the TEAP and a Task Force in 2005. The summary of these findings was thought to be important enough to be part of the TEAP 2006 Assessment Report. The total issue of bank management, which has a direct link to emissions, is further addressed in a separate chapter in this report

The following structure has been adopted in each section of the Executive Summary that refers to the specific Technical Options Committee:
- *Current status; what has been achieved*
- *What is left to be achieved*
- *The way forward.*

This structure does not apply to the Executive Summary of the TFED Report, and the chapters containing the full Executive Summaries and other material. Before that the different executive summaries of each TOC are given in this TEAP 2006 Assessment Report, the Executive Summary presents a number of key messages in section 1.1.

1.1 Key Messages

The technical developments that have occurred between 2002 and 2006, and which are described in this 2006 TEAP Assessment Report, have served to increase the technical and economic feasibility of each of the following for both Article 5 and non-Article 5 countries:

a. accelerating the phase-out of consumption of most ODSs,
b. limiting the use or reducing the emissions in many applications, and
c. collecting and destroying unwanted ODS contained in foam and refrigeration and other equipment.

The key findings can be summarised as follows:

Chemicals (CTOC)

- Some carbon tetrachloride (CTC) and CFC feedstock and process agent uses exempted by the Protocol could be replaced by hydrochlorofluorocarbons (HCFCs) or by not-in-kind manufacturing processes using non-ozone depleting substances (non-ODS). Parties may wish to consider periodic assessment of available and emerging alternatives and substitutes for feedstock and process agent uses with a view to restricting exempted uses.
- Regulatory and technical changes may continue to impact earlier phase-out of ozone depleting solvent applications by introducing non-ODS or new cleaning processes for the applications where suitable alternatives are not available.
- The phase-out of ozone depleting solvents in Article 5 countries will require: (1) access to information and knowledge about the acceptable alternatives, (2) economic assistance, and (3) identification of small and medium users.

Foams (FTOC)

- As a result of further transition in developing countries, chlorofluorocarbon (CFC) consumption for foam is now down to less than 1% of its 1986 baseline level.
- Hydrocarbons are now the largest single class of blowing agents in use globally (36% of the total). Hydrofluorocarbons (HFCs) have been introduced into some foam sectors, but price and the application of responsible use criteria have limited uptake to less than 60,000 tonnes globally (16% of the total).
- HCFCs also continue to have a significant part of the market (22% of the total) --despite phase-out in many non-Article 5 countries-- primarily because of rapid growth in the use of insulating foams (particularly extruded polystyrene -- XPS) in some Article 5 countries to improve the energy performance of new buildings. Some estimates suggest that up to 50,000 tonnes per annum of additional consumption could emerge by 2015.

Halons (HTOC)

- The civil aviation sector continues to be dependent on halons, has not demonstrated further progress through the adoption of alternative technologies in new airframe designs. The sector lacks an agreed technical design strategy to implement alternative methods of fire suppression. The International Civil Aviation Organization (ICAO) may not take up these issues up at their 2007 Assembly as previously agreed.
- Adequate supplies of halons 1211, 1301 and 2402 are expected to be available on a global basis; however, they are projected to be unevenly distributed amongst the major regions of the world. These regional

imbalances are a growing concern and may need to be addressed by the Parties.

Medical Applications (MTOC)

- Global phase-out of CFCs in Metered-Dose Inhalers (MDIs) is achievable by 2010. However, considerable challenges remain in achieving transition to alternatives, particularly in Article 5 countries.
- A relatively large number of companies manufacturing CFC MDIs in Article 5 countries do not yet have the skills or knowledge to phase out CFC MDIs. It is critical that technical expertise and funds for technology transfer and equipment are available to ensure that patients in Article 5 countries receive essential inhaled treatment.
- Pharmaceutical-grade CFC production for MDIs may be economically impractical after 2009. If global transition in CFC MDI manufacture is not achieved by 2010, Parties may need to consider the necessity for a final campaign production of pharmaceutical-grade CFCs and the acquisition of remaining stockpile from non-Article 5 countries.

Methyl Bromide (MBTOC)

- Technical alternatives exist for almost all controlled uses of methyl bromide.
- Phase-out for the remaining methyl bromide uses will be greatly influenced by the registration and the regulatory controls on several key chemical alternatives (including 1,3-dichloropropene, chloropicrin, methyl iodide and sulfuryl fluoride) and by the incentives for non-chemical alternatives and Integrated Pest Management.
- Full implementation of barrier films in soil fumigation could significantly reduce methyl bromide dosage rates and emissions.
- Increased use of methyl bromide for Quarantine and Pre-shipment (QPS) is offsetting gains made by reductions in controlled uses for soils and other non QPS uses. QPS methyl bromide use is particularly increasing in response to the International Standard for Phytosanitary Measures (ISPM 15) encouraging methyl bromide use on wooden packaging material despite the availability of an authorised alternative to methyl bromide for this use.
- Parties contemplating controls on exempted methyl bromide use may wish to consider economic incentives that encourage minimal use, containment, recovery and recycling; as well as not-in-kind alternatives and substitutes for the products that are traded.

Refrigeration and Air Conditioning and Heat Pumps (RTOC)

- The long product life and low failure rate of the estimated 1,200 to 1,500 million domestic refrigerators currently in use result in refrigerant emissions from this bank being dominated by end-of-life disposal of these units. The management of this bank is expected to be a global agenda topic for at least another 20 years.

- In contrast with non-Article 5 countries, CFCs and HCFCs will continue to be the primary service refrigerants in most Article 5 countries because of long equipment life and the costs of field conversion to alternative refrigerants. Containment and conservation are therefore likely to need increasingly more attention with time.
- As is the case in many non-Article 5 countries, there is still a significant number of aged CFC chillers operated in Article 5 countries, which are characterised by a high energy consumption and high CFC leakages. Replacement is in many cases very cost effective; however, investment capital is often lacking. Replacement strategies combined with financial and other incentives could be the most urgent actions to be considered to substantially reduce both direct and indirect greenhouse gas emissions.
- Several low Global warming Potential (GWP) refrigerant candidates (one with an ozone depleting ingredient – CF_3I) are claimed to provide comparable energy efficiency to HFC-134a in vehicle air conditioning. Development of these low-GWP refrigerants may also have major future consequences for (new) refrigerant choices in other sectors and applications.

Cross-Sectoral Findings

The following are cross-sectoral findings:

- Technically and economically feasible substitutes are available for almost all applications of HCFCs, although transitional costs remain a barrier for smaller enterprises, particularly in developing countries.
- Accelerated phase-out of HCFCs could lead to incremental energy efficiency benefits if existing, less efficient, equipment is retired early.
- A considerable portion of the 3.5 million ODP-tonnes of ODS contained in banks is available for collection and destruction at costs that can be justified by benefits in reducing ODS and greenhouse gas emissions.
- Parties contemplating collection and destruction may wish to consider incentives for collection that avoid prolonged use of inefficient equipment, intentional venting or product dumping. In this context, the classification of ODS recovery and destruction activities as carbon offset projects could warrant further investigation.
- Since 2002, TEAP and its TOCs have undertaken extensive work to co-ordinate with the Intergovernmental Panel on Climate Change (IPCC) on climate protection and to refine and improve estimates of ODS banks and emissions. Parties may wish to consider whether additional co-ordination will provide useful policy-relevant technical information and, if so, how such co-ordination can be encouraged.

1.2 Chemicals TOC

What has been Achieved

Process Agents

CTOC has taken over the work of the Process Agents Task Forces, providing information to Parties on nominations of Process Agents. Taking into account Table A in decision XVII/7 and Table A bis in decision XVII/8, there are now 68 nominations to be assessed.

Feedstocks

Feedstock uses were summarised in the 2005 CTOC Progress Report. ODSs such as CTC and methyl chloroform are feedstocks for the production of CFCs and HCFCs, the latter continuing in use in Article 5 countries until 2040. Methyl bromide and halon 1301 can be used as feedstocks in manufacture of detergents and pharmaceuticals. Estimated ODS emissions from feedstocks were on the order of 3,500 metric tonnes or 1,619 ODP tonnes in 2002.

Laboratory and Analytical Uses

Advice has been provided on essential uses of CFC-113 and CTC. A review was carried out of potential laboratory and analytical uses of methyl bromide. Methyl bromide can be used in laboratories as a 'methylating agent'. Alternatives to methyl bromide are generally available, but replacements in analytical applications can be more difficult to find.

Aerosol Products, Non-medical

Today more than 99.5% of non MDI aerosols use non-CFC formulations world-wide. The CFC consumption in this sector in 2003 and 2004 was around 2,000 tonnes in Article 5 countries and it is on the decline. There are no technical barriers to global transition to non-ODS alternatives, and many aerosol products have been replaced by not-in-kind substitutes such as mechanical pumps (finger or trigger pumps), sticks, roll-ons, brushes, etc as well as by non-ODSs.

Carbon Tetrachloride (CTC)

TEAP and CTOC provided a report on sources of CTC emissions and opportunities for reductions in 2006. Based on the calculation for the CTC demand 2002-2009, CTC emissions have been estimated. The discrepancy between emission data calculated from atmospheric concentrations and those derived from consideration of industrial activity is due possibly to under-estimation or under-reporting of the latter.

Solvents

Over 90 % of ODS solvent uses (based on the peak consumption of 1994-95) have been reduced by substitution to not-in-kind technologies and conservation. The remaining less than 10% of the ODS market is shared by several in-kind solvent alternatives.

Destruction and Other Issues

Under the decision XII/8, TEAP set up two separate task forces - Task Force on Collection, Recovery and Storage (TFCRS) and Task Force on Destruction Technologies (TFDT). Large amounts of: CFCs are contained in refrigeration equipment. CFC-11 remains in installed foams, and halons 1301 and 1211 in firefighting equipment. Some 16 of 45 ODS destruction technologies considered to meet the environmental and economic screening criteria adopted by the TFDT.

What is Left to be Achieved

Feedstocks

Halon 1301 is a very useful feedstock for preparation of bioactive compounds such as Fipronil, a broad-spectrum insecticide. A new development of non-ozone depleting trifluoromethylating agent will provide an option for resolution.

Laboratory and Analytical Uses

The reasons for slow progress in replacing ODS have been explored. It is estimated that laboratory uses of ODS could be reduced by 37% (over the 2003 figure) by 2008.

Solvents

The major challenges to total phase out are: providing access to information on already identified alternatives, overcoming economic considerations and identifying the small and medium users who, collectively, make up a major portion of the solvent market.

The Way Forward

Process Agents

The existing Process Agent nominations will be reviewed for the 19-MOP in 2007. Tighter collaboration between the Executive Committee (ExCom) and the TEAP will be important to clarify the real figures of process agent applications in Article 5 countries.

Feedstocks

TEAP and CTOC will continue to investigate on all feedstock uses, levels of emission and methods to limit emissions. The CTOC will keep monitoring feedstock uses of ODS that may not have been recognised formerly.

Laboratory and Analytical uses

Opportunities to reduce the use of ODS in preparative and analytical laboratories will arise as adoption of Green Chemistry practices. Meanwhile, the CTOC will maintain a watching brief on possible uses and report to Parties from time to time.

Aerosols, Non-medical

The completion of global CFC phase-out will occur in the near future as the reduction schedule mandated by the Montreal Protocol comes into force in Article 5 countries.

Carbon Tetrachloride (CTC)

Three potentially significant areas require further investigation to get better data for industrial emissions to enable resolution of the discrepancies with atmospheric measurements; the first area is to identify the production of CTC as a by-product and its subsequent use; the second area is to identify any other requirements for CTC and the third is the emission of CTC from sources such as landfills.

Solvents

Regulatory changes will continue to impact use of solvents. In some cases, this may require solvent and/or equipment change or a new cleaning process. The CTOC will investigate the Essential use Exemption of CFC-113 for aerospace applications by the Russian Federation for the years 2007 to 2010.

Destruction and Other Issues

One of the main synergies with the Basel, Rotterdam and Stockholm Conventions will be in the implementation of best practices in order to reduce and eliminate the use of certain chemicals and their waste, also reducing the pollution to the environment.

1.3 Flexible and Rigid Foams TOC

Current Status

In 2005, the consumption of CFCs in the foam sector dropped below 1% of the 1986 baseline consumption for the first time. This has been facilitated by the completion of virtually all projects in non-insulation applications and the near completion of those remaining in the insulation sector.

HCFC phase-out has now been achieved in a number of developed country regions. HCFC-141b continues to be used to a limited degree in Canada and Australia while more significant quantities of HCFC-142b and HCFC-22 continue to be used in North America, primarily to support the manufacture of extruded polystyrene (XPS) until 2010. In developing countries, HCFCs continue to be the dominant blowing agents in all insulation applications except for appliance foams, where the use of hydrocarbon blown foam continues to gain ground, particularly in the larger countries of Asia and Latin America. Of particular relevance at present, is the rapid growth of HCFC-142b and HCFC-22 consumption in China, driven by new XPS capacity. This is in turn driven by construction projects that are delivering in excess of 1 billion square metres of new floor area in buildings per year. The additional blowing agent demand from these sources against a 2001 baseline could amount to as much as 50,000 tonnes by 2015, having already added 20,000 tonnes so far.

The uptake of HFC technologies has been lower than expected in all regions and reached about 56,000 tonnes globally in 2005. This trend has been driven in part by the regulatory, economic and market pressures being exerted, particularly in Europe and Japan. However, innovative formulation methods have also contributed to the lower consumption figures. Limited HFC use is emerging in Latin America for appliances (mainly for export markets). Other minor uses include one component foams, integral skin foams and shoe sole applications.

Hydrocarbons are now well-established as the dominant blowing agent in most developed country regions. Other technologies are continuing to emerge, such as super-critical CO_2, which has now been commercially introduced for spray foam in Japan.

What is Left to be Achieved

There is expected to be little further challenge in phasing out the remaining use of CFCs in the foam sector, although some concern remains about the completeness of baseline reporting in some regions. Efforts to improve the UNEP reporting procedures, particularly with respect to end-use analysis, would greatly assist in ensuring transparency.

For HCFCs, there are a number of remaining challenges, two of which stand out. The first of these is the satisfactory phase-out of HCFC use in the North American XPS industry where the technical challenges differ considerably from those in Europe and Japan. The second challenge is to further assess and, if necessary, seek strategies to arrest the rapid growth in HCFC consumption in China and elsewhere. This will again involve close co-operation with the XPS industry. Adequate actions in this area could also have significant benefits for the climate.

In addition to these measures to address further consumption in the future, the foam sector affords the opportunity of managing blowing agents previous consumed, but still contained in the foams (the so-called banks). There are a number of opportunities available for doing this, some of which have already been implemented in various developed country regions (e.g. Europe and Japan). Recovery of blowing agents from appliances is generally easier than from building products, although recovery from some steel faced panels can be considered technically practical. If further measures are to be taken with appliances, the action needs to be fairly imminent, since many CFC-containing refrigerators are already reaching the end of their useful lives. This is also now true in developing countries where early retirement of inefficient refrigerators is seen as advantageous in limiting the need for additional power generation. For building insulation, the timescale is extended and most foams will not be entering the waste stream until 2015 or beyond. This leaves further time available for assessing and optimising end-of-life management techniques.

The Way Forward

The foam sector continues to provide a number of opportunities to avoid emissions of ozone depleting substances, both through on-going, and possibly additional, consumption measures and through end-of-life management strategies. However, the close interaction between ozone and climate issues in the foam sector, in terms of both the selection of CFC-alternatives and the on-going energy performance of insulation products makes the charting of the most appropriate environmental course a delicate operation. Appropriate end-of-life management strategies to minimise emissions from all foams could make this an easier task. Following this route would involve both the further characterisation of existing strategies (e.g. anaerobic degradation within landfills) as well as the potential exploration of innovative fiscal incentives to promote greater use of end-of-life management practices.

1.4 Halons TOC

Current Status

Only The Peoples Republic of China and the Republic of Korea continue to produce halons for fire protection purposes. Of more than 120 countries operating under Article 5, only 26 continue to import newly produced halons, primarily for the servicing of existing equipment. The use of halon 2402 as a process agent in the Russian chemical industry has substantially reduced the Russian inventory of halon 2402. Nevertheless, within Russia and the Ukraine there appears to be a sufficient quantity of halon 2402 for the servicing of existing applications.

The 2006 Assessment models estimate that the global bank of halon 1301 at the end of 2005 is 50,000 metric tonnes (MT), and the global bank of halon 1211 at the end of 2005 is 90,000 MT. Therefore, local and regional imbalances aside, the HTOC is of the opinion that adequate global stocks of halon 1211 and halon 1301 currently exist to meet the future service and replenishment needs of critical or essential halon 1211 and halon 1301 fire equipment until the end of their useful lives.

Halon use within the military sector is well managed, and many organisations have established dedicated halon storage and recycling facilities to support Critical Use equipment for as long as is necessary.

What is Left to be Achieved

There is growing concern from HTOC local and regional experts about the availability of halon 2402 to support the critical servicing needs of Russian produced aircraft, military vehicles, and naval vessels still in operation in countries outside of Russia and the Ukraine, particularly India.

In Article 5 countries, halon banking has been a mix of success and failure. In addition, the build up of stocks of contaminated or otherwise unwanted halons continues to be a problem in Article 5 countries, particularly in Africa and now also in China.

The civil aircraft sector continues to be dependent on halons, has not demonstrated further progress through the adoption of alternative technologies in new airframe designs, and lacks having an agreed technical design strategy to implement alternative methods of fire suppression.

The Way Forward

Within the civil aircraft sector, there is an immediate need to produce technical designs to conform with the minimum performance specifications that will in turn enable regulatory authorities to certify the systems to be fitted to new aircraft designs.

Well planned and managed halon banking schemes can play a significant role in ensuring the quality and availability of recycled halon in Article 5 countries, in managing the consumption down to zero, and in assisting with emission data by providing regional estimates that should be more accurate than global estimates.

While it appears that adequate supplies of halon 1211 and halon 1301 are expected to be available on a global basis, the majority of halon 1301 is projected to be in Japan, and the majority of halon 1211 is projected to be in China. As with halon 2402 in Russia and the Ukraine, these regional imbalances are a growing concern for the HTOC that may need to be addressed by the Parties.

1.5 Methyl Bromide TOC

Current Status

In 2005, global production for the MB uses controlled under the Protocol was about 18,140 metric tonnes, which represented 27% of the 1991 reported production data (66,430 tonnes) MB production in Article 5 countries for controlled uses peaked in 2000 at 2,397 tonnes, falling to 39% of the baseline, 538 metric tonnes, in 2005 (aggregate baseline for all Article 5 regions is 1,375 tonnes). Production for uncontrolled QPS uses was estimated to have increased from an average of about 10,000 tonnes used annually between 2000 to 2004 to 13,000 tonnes in 2005.

Global consumption of MB was reported to be about 64,420 metric tonnes in 1991 for controlled uses and remained above 60,000 tonnes until 1998. In 2000 it was estimated at 45,527 tonnes in 2000, and fell to about 26,336 tonnes in 2003. By 2003, MB consumption in non-Article 5 countries was reduced to about 14,520 tonnes, representing 26% of the baseline. The Meetings of the Parties approved 16,050 tonnes for Critical Uses in non-Article 5 Parties for 2005. Of this, less than 13,823 tonnes was authorised by national governments and reported consumption was 11,468 tonnes in 2005. This accounted for about 20% of the total non-Article 5 baseline.

Article 5 consumption for controlled uses peaked at more than 18,100 tonnes in 1998. Total Article 5 consumption was reduced to about 11,820 tonnes in 2003 (75% of the baseline) to 9,285 tonnes in 2005 (59% of the baseline). Presently, 87% of Article 5 consumption is estimated to be for soil fumigation and 13% for postharvest treatments.

The decline in total global consumption of MB is largely attributed to reductions in soils fumigation, although in Europe non-QPS postharvest uses have also been greatly reduced Reductions in the soil sector have been achieved by the adoption of chemical fumigant alternatives, such as 1,3 – D/chloropicrin, combinations of chemical and non-chemical control methods and the adoption of practices that avoid the need for MB, e.g., substrate cultures, grafting or integrated pest management strategies. In areas where critical uses for soil fumigation are still being requested, the adoption of barrier films, reductions in dosage rate and use of mixtures of MB with chloropicrin have also led to major reductions in MB use. Formulation changes and new or improved application methods have increased the effectiveness of several alternatives.

The uptake of alternatives for post harvest uses has varied depending on the situation and commodity treated. Technically feasible alternatives are available for almost all structural treatments and fumigation of durable commodities, although a number of constraints to further adoption still remain, including economic considerations, treatment and market logistics and regulatory and registration requirements. In structural applications, heat and sulfuryl fluoride and heat, CO_2 and phosphine are in commercial use. Thorough application of IPM approaches is a pre-requisite for the effectiveness of any treatment, including efficient use of methyl bromide. IPM systems without fumigants are in use in many countries. For durable commodities, phosphine, heat and vacuum are the leading alternatives. For QPS treatments of commodities, there are various approved (situation-dependent) treatments including heat, cold, modified and controlled atmospheres, fumigants, water treatments under pressure, chemical dips and irradiation.

Significant effort has been undertaken by many Parties to transfer, register and implement alternatives and to optimise their use. Lack of registration is still a major constraint to the uptake of effective alternatives in some countries. In most instances the adoption rates for alternatives vary between 10 and 25% per year. This includes Article 5 countries that have adopted alternatives through investment projects. In some sectors however, some countries report slower adoption rates even though a number of technical alternatives have been proven world-wide and many countries have been able to transition successfully.

MB phase-out in Article 5 countries has been achieved mainly through MLF investment projects, which have shown that a similar range of alternatives to those in use in non-Article 5 countries can be successfully adopted. Costs and different resource availability can lead to preference for different alternatives in Article 5 compared to non-Article 5 countries.

The fact that MB can often not be replaced simply by one in-kind alternative has become clear through both demonstration and investment projects. MB users may need to change their approach to crop production and even make important changes in process management. Particular attention needs to be paid to appropriate, effective application methods and adaptation to specific local conditions. Strong emphasis on awareness raising activities, information transfer and training, is still most important.

What is Left to be Achieved

Trends in the adoption of alternatives for CUE uses in non-Article 5 has occurred at approximately 16 to 32% a year since the CUE process commenced in 2003. Of the remaining 11,545 tonnes of MB used for CUEs in 2005, MBTOC estimates that technical alternatives exist for all, but for about 1,136 tonnes of MB. Adoption of these alternatives is being affected by different regulatory constraints within countries.

Areas where technical alternatives are proving more difficult include some specific nursery situations where certification is required, ginseng replant and elimination of *Striga* and broomrape in some situations. In postharvest applications, MBTOC has not identified technically effective alternatives for only four uses: high moisture fresh dates, fresh market chestnuts, cheeses in cheese storages, and hams in ham storages. Additionally, it is uncertain whether there are technically effective alternatives that are sufficiently protective of immovable historical objects and museum components when infested with fungi.

Although QPS uses of methyl bromide are usually for commodities in trade, one Party has identified some of its methyl bromide uses in soils as being quarantine uses. For the 2002-4 period, a survey showed the major use categories for QPS treatments were soil (preplant 29%), grains (24%), wood, including sawn timber (16%), fresh fruit and vegetables (14%), wooden packing materials (6.4%), logs (4.0%) and dried foodstuffs (3.0%). The use of QPS methyl bromide for treatment of whole logs and timber appears underrepresented in these figures. Independent estimates of the volume of methyl bromide required to treat East Asian and Russian trade in logs suggest that QPS methyl bromide use for this use exceeds 4,000 tonnes.

The Way Forward

The main crops for which MB is still being used and for which further efforts to adopt and scale up alternatives in specific non-Article 5 and Article 5 countries include; cucurbits (melons and cucumbers), peppers, eggplants, tomatoes, perennial fruit and vine crops (particularly replant), strawberry fruit, and nurseries for the production of propagation material for forest plants, strawberry runners and flowers.

Increasing regulation of fumigants, including MB, is placing pressure on industries to either adopt new production systems, which avoid the need for MB, or to seek new alternatives that are more environmentally sustainable and safer. Continuation of registration of various fumigants, further investment into methods that avoid the need for MB and possible registration of key alternatives, such as methyl iodide, will greatly influence the ability to phase out the remaining uses of MB economically. An accurate assessment of the economic impact of the adoption of alternatives is not available The existing literature on some alternatives and uses is narrow and to gain a better understanding more research would need to be done in all countries but especially in countries outside of the USA (particularly in Article 5 countries) and on a wider range of methyl bromide uses.

Studies in diverse regions, together with the large scale adoption of low permeability barrier films (LPBF) in Europe, have confirmed that such films allow for conventional MB dosage rates to be reduced and adoption of barrier films for all remaining critical uses will ensure that use/emissions of bromine can be further reduced. Equivalent effectiveness is achieved with 25 –50% less methyl bromide dosage applied under LPBF compared with normal polyethylene containment films.

For QPS treatments, MOP Decisions have urged Parties to minimise use and emissions of MB through containment and recovery and recycling methodologies, as well as to refrain from use of MB and to use non-ozone-depleting technologies wherever possible. Most commodity fumigation in non-Article 5 countries, especially for QPS applications, take place in well-sealed fumigation chambers with a high standard of gastightness. There are now several examples of recovery equipment in current commercial use. Further work and extension of recapture technology may be useful. There is potential for reduction of methyl bromide emissions from QPS uses of more than 90% of the quantity applied through adoption of recapture and efficient containment.

1.6 Medical TOC

Metered Dose Inhalers

Current Status

In 2005, approximately 4,650 tonnes of CFCs were used globally for the manufacture of metered dose inhalers (MDIs) for asthma and chronic obstructive pulmonary disease (COPD). This represents a 30 per cent reduction in CFC use since the last assessment.

It appears that MDIs are manufactured in at least 16 Article 5 countries. The amount of CFCs used in these countries in 2005 for the manufacture of MDIs is estimated at 1,875 ODP tonnes (equating to approximately 75 million MDIs). About 65 per cent of this consumption (1,283 ODP tonnes) is by nationally owned manufacturing companies.

Technically satisfactory alternatives to CFC MDIs are now available for short-acting beta-agonists and other therapeutic categories for the treatment of asthma and COPD. As anticipated, there have been no major problems with transition, including no major product issues.

What is Left to be Achieved?

Given the widespread availability of technically and economically feasible alternatives, MTOC believes that global phase-out of CFCs in MDIs is achievable by 2010. However considerable challenges will need to be addressed to achieve transition particularly in Article 5 countries. These challenges can be overcome through the transfer of technology, product launches of CFC-free alternatives and implementation of comprehensive transition strategies. There is an urgent need for all Article 5 countries that have not already done so to develop effective national transition strategies in accordance with Decision XII/2.

In some Article 5 countries there are a relatively large number of local companies producing CFC MDIs who have not yet gained access to the skills or knowledge to introduce suitable CFC-free alternatives. It is critical to ensure that appropriate technical expertise is identified, that funds for technology transfer and equipment acquisition are available, and that the management of the implementation is monitored.

The Way Forward

After 2009, the economics of CFC production may make pharmaceutical-grade CFC production for MDIs impractical. If Article 5 countries face difficulties in achieving transition in their CFC MDI manufacturing plants by 2010, stockpiling may need to be considered to ensure a supply of pharmaceutical-grade CFCs for MDI manufacturing to meet patient needs beyond 2009. In these circumstances, it may be appropriate to arrange for a final campaign to produce pharmaceutical-grade CFCs before 2010, or to acquire pharmaceutical-grade CFCs through a transfer of existing stockpile in non-Article 5 countries.

Future CFC requirements are difficult to predict given the uncertainties of transition, particularly in Article 5 countries. However, the volume of CFCs required under the essential use process in non-Article 5 countries is reducing and will likely be less than 500 tonnes in 2008, which may be the last year a request will be made. CFC use in Article 5 countries for MDI manufacture is currently estimated at about 1,800 ODP tonnes per annum.

If quantities of pharmaceutical-grade CFCs are needed to allow the transition to occur globally and there is a need for a final campaign production in the later part of the decade or for the transfer of existing stockpile, then this will need careful consideration and management. Issues that will need to be considered include: timeframe for transition; estimation of CFC quantities; existing stockpile of suitable quality; logistics, commercial, and legal requirements for stockpile transfer; storage; and destruction.

Pharmaceutical Aerosol Products Other than MDIs

Current Status

Technically and economically feasible alternatives are available for all medical aerosol products. The manufacture of most CFC-containing medical aerosols in non-Article 5 countries ceased around 1996, or possibly shortly thereafter if stockpiled CFCs were utilised.

What is Left to be Achieved?

It is only in some Article 5 countries that CFCs are still used in medical aerosols. China alone uses up to about 500 tonnes per year for Chinese traditional medicines, topical sprays and nasal sprays.

The Way Forward

The world-wide phase-out of CFC-containing medical aerosols will occur as CFC production for developing countries is phased out under the Montreal Protocol schedule and as part of individual Article 5 country plans.

Sterilants

Current Status

The use of CFCs in sterilisation has been successfully phased out in non-Article 5 countries and in many Article 5 countries. In 2006, global CFC use for this application is likely to be minimal. Remaining world-wide use can be easily substituted, as there are a number of viable alternatives. In 2005 the estimated use of HCFC replacement mixtures was thought to be less than about 30 ODP tonnes world-wide.

What is Left to be Achieved?

Remaining small uses of CFCs and HCFCs in sterilisation will be replaced over time with suitable alternatives. EO/HCFC blends have a small ODP (0.03) and are not being used in countries that have not been major users of the EO/CFC blend. HCFC mixtures are now used mostly in the United States and in countries that allow venting of HCFCs to the atmosphere.

The Way Forward

EO/HFC blends are expected to replace the EO/HCFC mixtures, where they are used. Sterilisation is an important process in the provision of good quality health services. Therefore, any alternative to the use of ODS needs to be well proven and tested to avoid putting the health of patients unnecessarily at risk.

1.7 Refrigeration, AC and Heat Pumps TOC

Current Status

The required global phase-out of CFCs and later also HCFCs, coupled with steps to reduce global warming, continues to drive transitions away from ODS refrigerants. The technology options are universal, but regional choices are influenced by local laws, regulations, standards, and economics. The primary current solutions are summarised below by application.

Refrigerants: More than 20 new refrigerants were commercialised for use either in new equipment or as service refrigerants (to maintain or convert existing equipment) since publication of the 2002 RTOC report. Additional refrigerants still are being developed, and research continues to increase and improve the physical, safety, and environmental data.

Domestic refrigeration: More than 96% of new production uses non-ODS refrigerants, primarily HFC-134a and isobutane (HC-600a). CFC emissions from the 100,000 tonne bank are dominated by final disposal due to the intrinsic equipment durability.

Commercial refrigeration: Most stand-alone equipment uses HFCs; but hydrocarbon (HC) and carbon dioxide (R-744, CO_2) use is growing, especially in Europe and Japan. Use of HCFC-22 (USA and Article 5 countries) and R-404A (Europe) dominate in new supermarket systems. CO_2, HCs, and ammonia (R-717) are used in Northern European countries. The ODS refrigerant bank is 185,000 tonnes of CFCs and 240,000 tonnes of HCFC-22. Annual supermarket systems emission rates range from 15 to 30% of their charge.

Industrial refrigeration: Ammonia (R-717) and HCFC-22 are the most common refrigerants for new equipment; costs have driven HFC-use in small systems. CO_2 use is gaining in low-temperature, cascaded systems. The ODS refrigerant bank is 20,000 tonnes of CFCs and 130,000 tonnes of HCFC-22. Annual ODS emission rates are in the 10-25% range.

Transport refrigeration: New production has shifted to non-ODS options, such as HFC-134a, R-404A and R-507A, with recent increases also for R-410A. Nearly all CFC-containing systems will be retired by 2010. The ODS refrigerant bank is 4,300 tonnes of CFCs and 17,000 tonnes of HCFC-22 with estimated annual emission rates of 25%.

Air conditioners and heat pumps: HFC blends, primarily R-410A, but also R-407C, are the most common near-term substitutes for HCFC-22 in air-cooled systems. HCs are an option for low charge systems and limited consideration of CO_2 continues. The refrigerant bank is 887,000 tonnes of HCFC-22 with estimated annual emissions at a rate of 18%. HCFC-22 recovery and containment are necessary to ensure adequate refrigerant supply for service.

Water-heating heat pumps: This small but rapidly growing application area is driven by energy efficiency. HFCs, primarily HFC-134a and R-410A, are replacing HCFC-22. CO_2 systems have been introduced in Japan and Europe. The ODS refrigerant bank is very small as historical application was at a low level.

Chillers: HCFC-22 continues to be used in small chillers; the use of HFC-134a, R-407C, and R-410A is increasing here. HCFC-123 and HFC-134a are used in larger centrifugal chillers. Ammonia or HC use is limited. The ODS bank is 107,000 tonnes of CFCs and 112,000 tonnes of HCFCs with estimated annual emission rates of 15% and 10%, respectively.

Vehicle air conditioning: HFC-134a has been used almost exclusively since 1994 in new systems in non-Article 5 countries, and now also globally. Environmental pressure such as recently adopted EU MAC directive is driving possible future replacement of HFC-134a in vehicle air conditioning by low GWP alternatives. CO_2 and also HFC-152a are currently among important candidates. The ODS-refrigerant bank is estimated to be about 60,000 tonnes of CFC-12 with an estimated annual emission rate of 10%. Few ODS-containing systems will remain in service after 2012.

What is Left to be Achieved

CFCs and HCFCs still are common in installed equipment. The CFC bank is approximately 450,000 tonnes, 70% of which can be found in Article 5 countries. The annual global CFC demand of approximately 50,000 tonnes per year is decreasing slowly. HCFCs form the dominant refrigerant bank, estimated as more than 1,500,000 tonnes, representing 60% of the total amount of refrigerants in use. Two thirds of this bank can be found in non-Article 5 countries. Current service needs are estimated at 200,000 tonnes per year. Efficient refrigerant recovery at end-of-life and retrofit to non-ODS service refrigerants are essential to avoid HCFC shortages in Article 5 countries. The critical years could be 2009 and 2010 in Europe and later on in the USA and other countries.

The refrigerant demand for service needs can be minimised by preventive maintenance to improve containment and by reusing the recovered and recycled refrigerant. Retrofitting to non-ODS refrigerant is another option. Refrigerant recovery is required in the USA and EU upon equipment decommissioning or retirement; it is receiving increasing attention in other non-Article 5 countries. The countries with successful recovery and recycling have achieved that with technician training, certification programs, and comprehensive containment regulations.

The technological options for air conditioning and refrigeration are expected to be much the same in the next four years as they are today. In applications with high emission rates, such as commercial refrigeration, designs with lower emissions, and conversion to low-GWP refrigerants, such as CO_2, are expected.

The Way Forward

Research will continue to develop additional refrigerant options. Efforts also will increase and refine the physical, safety, and environmental data for refrigerants, to enable screening, to optimise equipment designs, and to determine application requirements. Changing refrigerant options and efficiency goals are likely to drive further innovations in air conditioning and refrigeration equipment. Technical solutions are being developed to lower refrigerant charges in equipment, thereby decreasing refrigerant emissions. Use of indirect systems (applying heat transfer fluids in secondary loops) is increasing to reduce charge sizes, to enable use of sealed systems, and to facilitate application of flammable ODS alternatives. Since the recently adopted EU F-Gas Regulation will ban HFC-134a and other refrigerants with GWPs exceeding 150 in new vehicle models by 2011, the industry will be forced to make a second refrigerant change in mobile air conditioning. Several candidates continue to be evaluated, including CO_2 and R-152a as well as new low-GWP refrigerants, some of which may have low ODPs. Development of these low-GWP refrigerants also may have future consequences for the refrigerant choices in other applications.

The use of HCs and CO_2 in stand-alone commercial refrigeration equipment is expected to grow, mainly in Europe. HFC blends are the most likely near-term refrigerants to replace HCFC-22 in several applications. The dominant HCFC-22 bank is expected to continue to grow for a number of years, and the HFC bank is expected to increase rapidly, at least during the next decade.

Contrary to non-Article 5 countries, the demand for service refrigerants in most Article 5 countries will consist of CFCs and HCFCs, a tendency driven by long equipment life and with the costs of field conversion to alternative refrigerants. One of the main concerns will be maintaining adequate supplies of HCFCs. Refrigerant conservation programs to be established for CFCs in Article 5 countries will mostly be government sponsored and regulatory in nature. As in many non-Article 5 countries, they may include restrictions on the sale, use, and end-of-life disposal requirements that mandate recovery and recycling of refrigerants. These programs will be expanded in countries without such requirements.

1.8 HCFCs – Future Scenarios

Comparisons for the period to 2015 between the production and consumption identified and predicted in the 2003 HCFC Task Force Report and parallel data emerging from more recent assessments (e.g. the 2006 TEAP Task Force on Emissions Discrepancies) show that, even in the space of three years, the most likely demand profile has changed significantly. The primary causes of this accelerated growth in demand for HCFCs are rooted in the overall economic growth statistics of a number of significant developing country regions such as China and India.

Sectors experiencing particular growth in demand are commercial refrigeration, stationary air conditioning and insulation foams. Some estimates for HCFC-22 are already suggesting that demand could reach 500-600k tonnes by 2010, which is already higher than earlier market predictions for 2015. Although much of the production capacity for HCFC-22 remains in the developed countries, there is a rapidly increasing base of production in developing countries as well. There is a risk that this may partially be fuelled by the availability of certified emission reduction credits (CERs) under the Clean Development Mechanism when action is taken to mitigate HFC-23 by-product emissions. The UNFCCC is working hard to close this potentially perverse incentive, but has some major challenges in defining 'new capacity' and also identifying that element of HCFC-22 demand which is going to non-emissive feedstock applications. TEAP has been requested by Parties at MOP-18 to assist in interpreting the respective impacts of this complex mix of drivers.

Meanwhile, growth in demand for other HCFCs (e.g. HCFC-141b and HCFC-142b) is more closely linked to non-refrigeration applications. Although HCFC-141b growth will continue to be driven by remaining replacement of CFC-11 and natural market growth in the closed-cell foam sector, there is concern that an additional and growing volume of the chemical is being consumed as a solvent or within other emissive applications. Further work is required to ascertain the precise end-use consumption patterns within these potentially emissive applications.

For HCFC-142b, the use pattern is closely linked to the foam sector, particularly the extruded polystyrene (XPS) application. The availability of relatively inexpensive extruding equipment in China and elsewhere and the low cost of polystyrene as a feedstock have both contributed to XPS being the insulation material of choice. With new building burgeoning in many developing country regions, the growth of HCFC-142b/22 use in the foam sector could add an additional 50,000 tonnes of annual consumption to these gaseous blowing agents by 2015.

1.9 Banks and Bank Management

In 2005, the IPCC/TEAP Special Report on Ozone and Climate (SROC) focused attention on the substantial remaining legacy of large historic use of ODSs in applications which were not significantly emissive in the short-term. The materials are stored up in what have become known as 'banks'. In 2002, these were estimated to exceed 3.5 million ODP tonnes and will still be at over 2 million ODP tonnes in 2015. This finding has had implications for the assessment of the future impact of historic ODS consumption and it was realised that the current depletion of the ozone layer, did not reflect the full impact of this historic consumption.

Since that realisation across the ozone community, there has been substantive and close co-operation between the Science Assessment Panel and the TEAP in order to make assessments of the impact of on-going releases of ODS into the atmosphere well into the future. The dynamics of such releases are complex because the nature and locations of the banks are, in many cases, diverse. Nevertheless, the Science Assessment Panel has been able to establish that the recovery of the ozone layer may be significantly affected by the on-going release of banked ODS.

On the more positive side, banks can offer opportunities for recovery of ODS which can not only limit further impacts on ozone recovery but can also have considerable climate benefits. Accordingly, the Parties have asked TEAP to focus a number of its recent activities in further quantifying the banks and, in particular documenting methods of emission reduction from them and the potential for recovery practices at end-of-life. Many of these methods and practices had already been adopted in some regions of the world as a general expression of good environmental practice. However, the significance of these measures is certainly now more prominent as a result of the SROC.

One of the on-going barriers to bank management is the economics of the selected measure, which can vary substantially by sector/application and by region. Although ODSs are not included in the basket of greenhouse gases under the Kyoto Protocol, there is currently a growing interest in using the voluntary carbon market as a possible vehicle for funding ODS recovery that would otherwise be classified as uneconomic. Although protocols still need to be written to ensure environmental probity, the voluntary market could establish a value for such projects on the basis of their demonstrable climate benefits rather than against a strict adherence to the Kyoto flexible mechanisms (e.g. the CDM).

1.10 Task Force on Emissions Discrepancies

The Task Force on Emissions Discrepancies compared the emissions determined from atmospheric measurements with the emissions calculated via bottom up methods for refrigeration, AC and foams. It presented concluding remarks as follows.

1.10.1 General Comments

This assessment of the available data on emissions derived from bottom-up models and atmospheric measurements has indicated better than expected correlation for most chemicals reviewed. However, the following specific observations should be highlighted:

- No single data source from UNEP, AFEAS or any of the bottom-up methods adopted can be considered as providing a uniquely accurate snapshot of the total situation. Accordingly, on-going development in the quality of each source will remain important.
- There is considerable variability in consumption and resulting emissions estimated year-to-year in the early phases of introduction of a new chemical while reporting practices become established
- There is particular sensitivity to the completeness and accuracy of the UNEP consumption dataset because differences between the dataset and bottom-up analysis are assumed to be representative of emissive applications.
- There is still work to be done with HCFC-142b in establishing its emission sources and particularly rates of loss from thermoplastic foams. This may include the continuing development of more versatile bottom-up models.

1.10.2 Conclusions Regarding CFC-11

The discrepancies between emissions derived from bottom-up methods and those derived from atmospheric measurements are largest for CFC-11. Whether this is a systematic discrepancy remains a matter for further study. However, the following observations have emerged from this study:

- There is no concrete evidence to suggest that CFC-11 emissions from closed cell foams are being under-estimated at present, although there is potential that first-year losses could have been higher than forecast in the earlier years of specific technologies.
- The currently estimated bank of CFC-11 in foams would not, in itself, be sufficient to make-up the cumulative difference between bottom-up and atmospherically derived estimates over the period of use in foams.
- The discrepancy between bottom-up and top-down emissions estimates for CFC-11 suggests the potential for additional emissive

uses for CFC-11 that are, as yet, unaccounted for within the UNEP dataset.

- The global atmospheric lifetime of CFC-11 and other gases have substantial uncertainties that directly affect emission estimates from the top-down approach. A lifetime of 65 (52-88) year would be required to minimise the discrepancy between CFC-11 emissions derived from top-down and bottom-up methodologies. Because this lifetime is larger than the best estimate, CFC-11 lifetime of 45 (35-57) year, which is derived from modelling and observation-based methods, it is unlikely that the entire emissions discrepancy results from an error in the CFC-11 lifetime.

1.10.3 Significance for Current Bank Sizes and Future Emissions Projections

One of the objectives of Decision XVII/19 was that further study of discrepancies between emissions derived from bottom-up and those derived from atmospheric measurements could allow for improved estimates of present-day bank magnitudes and, ultimately, future emissions of ozone depleting substances. As a result of the analysis conducted as part of this report the following conclusions can now be drawn:

- It remains true that atmospheric projections of future halocarbon emissions and atmospheric mixing ratios depend upon the size and character of present day banks and the rates of emissions from these banks as well as emissions resulting directly from future production and use.

- In comparison with the situation described in Annex 11B of the Special Report on Ozone and Climate, it has been possible to reconcile the various methods used to derive emissions from bottom-up modelling and from atmospheric measurement for most ODS. The only possible exception is CFC-11. This reconciliation has been partly due to a reassessment of the impact of atmospheric lifetimes and mixing ratios on the one hand and uncertainties in consumption patterns and emission functions on the other.

- This provides further evidence that there is no fundamental error in either approach but that appropriate caution is necessary in relying on either dataset independently of the other.

- In the case of CFC-11, it may be necessary to carry out further analysis of the use patterns represented in the UNEP consumption dataset before drawing further conclusions on the size of present-day banks and likely future emissions.

1.11 Low-ODP Substances

Original controls under the 1987 Montreal Protocol capped halon production and consumption and reduced CFC production and consumption by 50%. As the science became clear that more must be done, Parties added ODSs to lists of controlled substances and accelerated their phase-out. Today, only the lowest ODP substances are not controlled. Uncontrolled ODSs with significant market potential include n-propyl bromide (nPB) and trifluoromethyl iodide (CF_3I).

Since 1997, various Decisions (e.g. particularly IX/24, X/8, XIII/5, XIII/7) urged reporting any uncontrolled low-ODP substances, asked the Scientific Assessment Panel to assess the ODP of such substances and the possible effect on the ozone layer, asked the Technology and Economic Assessment Panel to evaluate the current and potential use of each substance, and urged Parties to discourage the development and promotion of such substances.

The April 1999 TEAP Progress Report predicted significant production of nPB and reiterated that nPB could be safely used only under limited circumstances where emission controls and worker exposure protection could minimise the effects of potential toxicity.

The May 2000 SAP report "Assessing the Impacts of Short-Lived Compounds on Stratospheric Ozone" reported that an uncontrolled substance containing chlorine or bromine would be harmful to the ozone layer only if the substance has 1) vapour pressure sufficient to generate a significant gas-phase concentration in the atmosphere, 2) low solubility in water, and 3) a lifetime in the lower atmosphere long enough for it or its halogen-containing degradation products to reach the stratosphere. The SAP explained that the amount of low-ODP emissions reaching the stratosphere was strongly dependent on the region and season of emission. Parties therefore encouraged TEAP to provide the SAP with emission estimates for nPB by latitude and season.

The 2001 TEAP "Task Force Report on the Geographical Market Potential and Estimated Emissions of n-Propyl Bromide" presented estimates of latitude-specific emissions and reported that nPB is aggressively marketed for applications traditionally using ozone-depleting and non-ozone-depleting substances.

Since 2003, TEAP/CTOC has reported the updates of nPB under Decision XIII/7 with general information on production, consumption and emissions, as well as toxicity data and regulatory actions in the 2005 and 2006 TEAP Progress Reports. No accurate production and emissions estimates are available because there is no yearly reporting by the Parties. The SAP 2006 Assessment Report includes the latest estimates of the latitude-specific ODPs.

The ODPs of nPB are 0.1 for tropical emissions and 0.02-0.03 for emissions restricted to northern mid-latitudes, unchanged from the previous assessment.

In 2006, Honeywell proposed a new refrigerant blend of tetrafluoropropylene with CF_3I as a minor ingredient, which is one possible option to satisfy the EC F-gas MAC Directive (2006/40) that requires a phase-out between 2011 and 2017 of HFC-134a use in air conditioning systems installed in new vehicles sold in the European Union.

The upper-limit ODPs for CF_3I are 0.018 for tropical emissions and 0.011 for mid-latitude emissions. The previous SAP report had an upper limit of 0.008. TEAP and its Refrigeration TOC have not yet estimated the possible future fleet of automobiles, the likely penetration of air conditioning systems, the portion of new vehicle air conditioners that may use the Honeywell ODS blend, the likely service practices, and the total possible emissions under the worst case scenario.

Parties may wish to re-consider the earlier proposal by the SAP and TEAP of phasing out all ODSs pending full assessment by the Assessment Panels. Production and consumption of specific chemicals proved to be harmless to the ozone layer could be permitted after the assessment through an adjustment of the Protocol. Industries proposing new potential ODS could support research to obtain information on the substances' actual ozone-depletion potential.

1.12 Military Progress

Military organisations have made significant progress in eliminating ODS use. The remaining uses are primarily halons and refrigerants. In non-Article 5(1) countries, these applications continue to be satisfied by recycling existing stocks of ODS. A small number of uses have been met through Essential Use Exemptions. Information about military ODS uses and alternatives is not as readily available as for the commercial sector. But many countries have provided information through a series of global military workshops and multilateral and bilateral military-to-military exchange projects.

The military has begun producing the first modern aircraft that do not use halon in engine nacelles. Five such military aircraft are currently in final development or production in the U.S. and U.K.

Dry bays are the interstitial spaces within aircraft structures adjacent to fuel tanks, that contain electrical cables, hydraulic lines or other equipment and which can be the source of fires or explosions. Inert gas generators are beginning to replace halon in new aircraft.

Two types of aircraft use halon during combat to inert the ullage space in their fuel tanks within wing structures. One of these, the F-16, is used by many countries. There are as yet no alternatives that can be retrofitted into these aircraft.

Halon 1211 is used by some countries in wheeled extinguishers placed adjacent to aircraft parking spaces for "first response." An aircraft can take off following a small pooled-fuel extinguished by halon, but not with other agents.

Because the choice of fire protection for ships and submarines is very platform-specific, a solution for one vessel or application is not necessarily a solution for all. As a result, halon usage across vessels is not consistent. Parties replace halon on warships as specific conditions and costs permit.

Some shipboard CFC refrigerant applications will remain for the foreseeable future due to a lack of economically viable retrofit options and high retrofit costs where alternatives are available. All CFC systems on EU ships and submarines will have been converted to HFC alternatives by the end of 2008 because of a legal mandate.

New technologies have only recently been introduced that can replace halon in ground combat vehicles. Crew protection systems activate very quickly and provide significantly improved crew survival rates. It is unlikely that existing vehicles can be modified, but alternatives should be designed into future vehicles.

Halon has been or is being removed through attrition from virtually all buildings. This removed halon has become the primary source of recycled halon for support of continuing uses in weapons platforms.

Canada, Germany, Norway, Sweden, the UK and the United States reported that they have virtually eliminated the use of ozone-depleting solvents in other military applications. Methyl chloroform available under an Essential Use exemption is used to manufacture solid rocket motors for propelling large payloads into space.

It is easier to design halon alternatives into new equipment than to modify existing equipment. Military systems tend to have very long lifetimes, lasting half a century or longer. They are highly integrated, highly constrained in terms of space and weight, and modification costs are generally very high.

Since its 1989 report, the Halon Technical Options Committee's military experts have described halon uses in weapons systems that would persist beyond a phase-out date, and have predicted that new halon production would not likely be necessary provided that existing halon inventories were managed in a way that preserved them for ongoing military requirements.

These estimates and predictions appear to remain valid today. It appears likely that some ODS will continue to be necessary for legacy systems until mid-century, without additional technical breakthroughs.

There appears to be adequate supplies of halon 1301 to meet critical defence needs. Supplies of halon 1211 are less clearly in surplus with some indications of a shortage in some countries. There is growing concern about the availability of halon 2402 outside of Russia. In particular, India has reported a growing shortage that could be problematic. India also reported that halon 2402 systems are being routinely converted to halon 1301 to improve safety and help ensure future supplies.

Supplies of recycled or recyclable ODS are not always located in the areas where they are needed. Transnational shipment for reconditioning and re-use had become an occasional problem for military organisations. As global supplies decline, the need for flexibility in moving ODS to locations they are needed is becoming increasingly important.

AL-07-001-1744

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 23 2007

OFFICE OF
SMALL AND DISADVANTAGED
BUSINESS UTILIZATION

The Honorable Albert R. Wynn
House of Representatives
Washington, D.C. 20515

Dear Congressman Wynn:

Thank you for meeting with the Agency on May 18, 2007 to discuss our small and minority business program. This responds to your request that we provide you a report of the "good things" the Environmental Protection Agency (EPA) is doing to support small businesses. As I mentioned during our meeting, EPA has made great strides under the leadership of Administrator Steve Johnson and Deputy Administrator Marcus Peacock, who have exhibited a keen interest in the Agency's small business programs. I report directly to Mr. Peacock, and we meet regularly to discuss strategies and issues regarding the programs that come under my purview.

Attached is EPA's first report to the Small Business Administration's "Small Business Procurement Scorecard." As you will see, we are working pro-actively to increase opportunities for small and minority businesses to work with EPA and help us meet our goals of protecting human health and the environment for the American people.

Again, thank you for meeting with us. We appreciate your interest in the small business program and I look forward to the opportunity to update you on other projects in the future. If you have any questions regarding this report or other efforts we have undertaken, please do not hesitate to contact me, or your staff may contact Pamela Janifer in the Office of Congressional and Intergovernmental Relations at (202) 564-6969.

Sincerely,

Jeanette L. Brown
Director

Attachment

U.S. ENVIRONMENTAL PROTECTION AGENCY

SMALL BUSINESS PROCUREMENT SCORECARD (SBPS)

1) Has the agency implemented a strategy to increase the number of competitively awarded contracts to small businesses?

EPA has implemented a successful strategy to increase the number of competitively awarded contracts to small businesses. In FY2006, compared to FY2005, EPA increased the percentage of contracts awarded to all six categories of small businesses (see the below table).

Category	FY2006/2007 Goals	FY2005 Actuals	FY2006 Actuals
Small Business	36.0%	34.7%	36.2%
Small Disadvantaged Business	10.5%	10.9%	12.9%
8(a) Firms Only	7.5%	6.5%	8.2%
Women-Owned Small Business	5.5%	5.0%	5.6%
HUBZone Firms	3.0%	0.8%	2.1%
Service-Disabled Veteran-Owned Small Business	3.0%	0.2%	1.6%

In 2006, EPA created an internal small business performance measure under GPRA to increase the percentage of EPA contract dollars awarded to: 1) Service-Disabled Veteran-Owned Small Businesses (SDVOSBs), 2) Women-Owned Small Businesses, and 3) 8(a) firms. Four program offices at Headquarters participated in this initiative in the second half of FY2006; six program offices and four Regions are participating in FY2007; and all Headquarters program offices and all Regions are scheduled to participate in FY2008. In an effort to promote the small business program, OSDBU has aggressively undertaken steps to publicize the program both internally and externally. For example, we provide a quarterly Small Business Goal Accomplishment Report through which the Agency's senior leadership tracks the small business performance of their office; we have created an internal recognition program which provides visible quarterly recognition for those offices meeting their targets; and each fall, we conduct a Small Business Awards Ceremony which recognizes the top performing small businesses and the top performing program offices, Regions, and individual employees.

Each year, EPA's Headquarters sponsors at least eight major outreach sessions for small businesses. OSDBU is the lead sponsor for a majority of these sessions. The sessions target various categories of small businesses. Their purpose is two-fold: first to provide small businesses with information regarding EPA and its programs and, second, to provide specific information to the businesses on the processes and procedures required to effectively compete for contracts with the Agency. Additionally, the Agency's Office of Acquisition Management annually sponsors two contractor forums; its two major buying facilities in Cincinnati, Ohio and Research Triangle Park, North Carolina also host annual outreach sessions. Lastly, a number of the Agency's program offices and Regions hold "vendor days" to give small businesses exposure to buying officials. These outreach sessions provide small businesses insight into "how to do business with EPA" and provide them with opportunities to meet Agency procurement and program personnel.

OSDBU and EPA's Office of Acquisition Management work together in issuing an internal annual call letter for acquisition plans for the upcoming five-year period. After the program offices and Regions submit their plans, meetings are held to discuss upcoming procurement opportunities and identify specific contracts in all of the Agency's program areas that can be set aside for small businesses. These meetings have made the program offices and Regions more aware of the types of contracts that can be set aside for small businesses, which has resulted in more contracts actually being set aside. Through our establishment of this acquisition planning process, we increased the percentage of contract dollars awarded to small businesses.

In FY2005, EPA developed an internal strategy to implement E.O. 13360 to provide opportunities for SDVOSBs to increase their contracting and subcontracting opportunities at EPA. EPA's outreach to SDVOSBs include conferences throughout the nation, including conferences in Washington, D.C., Maryland, Virginia, Ohio, California, Nevada, and Illinois. EPA was recognized with three awards by the Veterans Administration at its "Annual Champions of Veterans Enterprise" awards ceremony in June of 2007:

i. Region 5 was recognized for awarding $4.4 million (4.7% of its contract dollars) to SDVOSBs in FY2006;
ii. Region 7 was recognized for awarding $3.9 million (11.3% of its contract dollars); and
iii. EPA's OSDBU was recognized for increasing opportunities for veterans at EPA, noting that EPA awarded a mere 0.08% of its contract dollars to SDVOSBs in FY2004, tripled that percentage to 0.24% in FY2005, and increased it exponentially by an additional 585% (to 1.64%) in FY2006.

Another innovative approach by OSDBU was the creation of a Small Business Outreach Center (the first of its kind) to provide outreach to the small business and socioeconomically disadvantaged communities. The Outreach Center is designed to serve as a resource for the Agency on small business matters by providing counseling and technical assistance to small businesses. While the Outreach Center is temporarily closed as we complete the competitive process for its relocation, we fully expect that upon its reopening it will continue to provide guidance to small businesses that have extremely limited experience with the federal government, and will assist more experienced small businesses in making contacts with key Agency program personnel involved in the acquisition process.

2) *Has the agency demonstrated top-level commitment to small business contracting?*

EPA's small business programs have the commitment of the Administrator, Steve Johnson, and the Agency's senior leadership. EPA's top-level management has demonstrated a keen interest in the Agency's small business programs. EPA's OSDBU Director reports directly to EPA's Deputy Administrator, Marcus Peacock, and they meet regularly to discuss strategies and issues regarding EPA's small business program. Their meetings include discussions of the effectiveness of EPA's small business performance measure on increasing the percentage of procurement dollars awarded to small businesses. It appears that the existence of this performance measure has had a positive impact on the percentage of awards made to all categories of small businesses, as the accomplishments under all socioeconomic categories have constantly improved since the inception of the performance measure. The OSDBU Director is included in the Administrator's weekly senior staff meetings. Following the release of each quarterly Small Business Goal Accomplishment Report, the Deputy Administrator discusses the program with EPA's senior managers at the Administrator's senior staff meetings. He gives kudos and accolades to those program offices and Regions that had done well, and queries those who need to improve. Last year, the Deputy Administrator included EPA's small business goals in his "Quarterly Management Report" – a short list of important Agency-wide programs and performance measures he tracks quarterly. (See page 10 of the EPA Quarterly Management Report, which is available online at http://www.epa.gov/ocfo/qmr.) Recently, when the OSDBU Director was asked to meet with Congressman Wynn to discuss EPA's small business program, the Deputy Administrator asked to be included in the meeting because he was eager to tell Congress of EPA's success in the small business arena. By his actions and his words, he has made it clear that he really does believe that small businesses can and do "make a difference". He takes the program seriously and has made a commitment to continue to strive to ensure that small businesses are provided increased opportunities to work with EPA to help us meet our goals of protecting human health and the environment for the American people. The OSDBU Director also meets with the Agency's Chief of Staff and Deputy Chief of Staff on an ongoing basis. She and her staff are actively involved in the Assistant Regional Administrators' (ARA) monthly conference calls and quarterly ARA meetings, as well as other forums to further advance the program among the Agency's leadership, such as regularly scheduled meetings and conference calls with managers in the Superfund program.

3) Does the agency have a comprehensive small business program that includes written policies and procedures focused on improving the competitive environment and increasing small business participation in the procurement process?

EPA has a comprehensive small business program that includes written policies and procedures that focus on improving and strengthening the competitive environment for small businesses. These policies and procedures are cited in the EPA Acquisition Handbook, the Contracts Management Manual (CMM) and the Environmental Protection Agency Acquisition Regulations (EPAAR). EPA releases an Annual Call Letter for Submission of Acquisition Plans, in accordance with the policy set forth in the EPA CMM, (CMM Chapter 7, Section 7.1, Three-Year Acquisition Plan) throughout the Agency; this call letter is jointly signed by the Director, Office of Acquisition Management (OAM) and the OSDBU Director. This annual call letter reminds the Agency's program offices of "the Agency's commitment to contracting with small businesses." It emphasizes the importance that "[t]he various small business contracting programs help ensure that all segments of the small business community are afforded an opportunity to participate in the procurement process." All program offices are required to submit to OAM and OSDBU their intended procurements for the upcoming fiscal year for a three-year planning cycle. Once all of the programs have provided their plans, OAM and OSDBU meet with the respective program offices and review and discuss their procurement intentions. At this time, OSDBU provides its assessment of the requirements and informs the program offices which procurements should provide additional opportunities for small businesses. Agreements are then made between the program office, OSDBU and the Contracting Officer to set aside the identified procurement for small businesses.

Should a requirement that was originally determined to be set aside as discussed in the planning meeting be changed, the program office and the Contracting Officer, are to inform OSDBU of this change. There has to be a written memorandum from these offices that explain the mitigating circumstances. OSDBU reviews, analyzes and ultimately provides a determination to the validity of the change from the originally agreed upon plan of action.

"CMM 7.2.4 Contract Bundling" sets forth EPA's policies and procedures associated with the oversight of acquisitions to guard against and mitigate the bundling of contracts. CMM 7.2.5 specifically provides policy guidance that concurs with the Federal acquisition policy, "to eliminate unnecessary contract bundling and to mitigate the effects . . . ." EPA's policy dictates that the Contracting Officer and OSDBU "should include a discussion on bundling as part of [the] annual meetings with customer program offices . . . ." True to policy set forth in CMM 7.2.5.6, OSDBU plays an active role in acquisition planning and participates in the acquisition meetings. During these meetings OSDBU plays a key role to ensure and guard against any contract bundling to afford the greatest amount of procurement requirements for small businesses.

4) Has the agency made small business goal achievement a rating element for acquisition personnel?

The performance standards of EPA's Senior Executives include a "Business Acumen" performance standard for which they must provide senior management annual feedback on their accomplishments with respect to the President's Management Agenda and management priority areas, such as competitive sourcing, contracts/procurement, assistance agreements/IAGs, financial management, etc. Additionally, the performance standards of the following Senior Executives include performance language relating to their accomplishments in implementing EPA's Service-Disabled Veteran-Owned Small Business strategy:

- Assistant Administrator of the Office of Administration and Resources Management (EPA's designated senior-level official);
- Chief Acquisition Officer;
- Director and Deputy Director of the Office of Acquisition Management;
- OSDBU Director;
- The responsible official for each Assistant Administrator and Regional Administrator;
- The Deputy Chief of Staff;
- Senior Resource Officials; and
- Division Directors in the Office of Acquisition Management.

The following language is included in the performance standards of personnel who work on the Direct Procurement Team in EPA's OSDBU office:

- Effectively promote and support meeting or exceeding the Agency's small business/ socioeconomic procurement program goals and commitments. This supports EPA's Small Business Performance Measure under GPRA.

- Establish goals and objectives for direct procurements in conjunction with the Small Business Administration and the EPA appropriations act.

- Implement and meet socioeconomic goals contained in statutes and executive orders.

The following is a sampling of the type of language that is included in the Performance Standards of EPA personnel working in EPA's Office of Acquisition Management.

- <u>Division Directors</u> – Accomplish effective annual acquisition planning with customers, in coordination with Small Business Specialist, to identify specific procurements that meet PBC and socioeconomic goals, including SDVOSB . . . .

- <u>Service Center Managers</u> – Contribute to the attainment of EPA's socioeconomic goals, including Service Disabled Veteran Owned Small Businesses, by ensuring that all acquisitions processed by (service center name) include market research which utilizes on-line tools and other available resources to identify qualified resources.

- <u>Team Leaders</u> – Contribute to the attainment of EPA's socioeconomic goals through the use of market research skills, including the use of on-line tools to identify qualified sources for new acquisitions.

- <u>Contract Specialists</u> – Contribute to the attainment of EPA's socioeconomic goals through the use of market research skills, including the use of on-line tools to identify qualified sources for new acquisitions.

In EPA's Regional offices, the performance standards of many employees involved in the acquisition process include performance standards for their responsibilities with respect to EPA's socioeconomic goals. The performance standards of all Regional acquisition personnel are scheduled to include socioeconomic goals beginning in CY2008; many Regional offices are using the above sample language provided by the Office of Acquisition Management in fashioning their performance language.

5) Does the agency work cooperatively with SBA on outreach and marketing initiatives?

EPA has actively and cooperatively participated with the Small Business Administration at various outreach and marketing initiatives held throughout the nation. EPA has staunchly supported SBA's matchmaking sessions, outreach conferences and marketing initiatives. For this reporting period, these events include:

Date	Event	Location
November 2006	Metro Tech Community College	Atlanta, GA
January 10, 2007	SBA Expo for Veterans and Small Businesses	Louisville, KY
January 30, 2007	PTAC and SBA Conference for Veterans and Small Businesses	Chillicothe, OH
February 2007	Veterans Conference	Elyria, OH
February 22, 2007	Strategies and Tactics for Entrepreneurial Women	Denver, CO
March 2007	SBA Matchmaking	Cleveland, OH
March 2007	State Conference Matchmaking	Columbus, OH

EPA personnel are active members and participants at the monthly SBPAC meetings. EPA's Region 8 small business coordinator is a member of the Rocky Mountain Small and Disadvantaged Business Opportunity Council (SADBOC), whose members include small businesses and federal government personnel, including SBA. In January 2007, EPA's small business coordinator at the EPA Research Triangle Park, North Carolina facility partnered with the SBA District Office in Charlotte, NC and the local PCR. This interagency planning committee co-sponsored the 2007 Marketplace Procurement Opportunities for Small Businesses with three U.S. Congressmen, in Raleigh, North Carolina.

6) Does the agency meet deadlines for all required strategic plans and annual reports that are due to SBA?

EPA consistently meets deadlines for all required strategic plans and annual reports due to the Small Business Administration. In accordance with Executive Order 13360, EPA has implemented its strategic plan to improve contracting opportunities for SDVOSBs. This has included, as noted in question 1 above, the following information:

EPA's outreach to SDVOSBs includes conferences throughout the nation, including conferences in Washington, D.C., Maryland, Virginia, Ohio, California, Nevada, and Illinois. EPA was recognized with three awards by the Veterans Administration at its "Annual Champions of Veterans Enterprise" awards ceremony in June of 2007:

iv. Region 5 was recognized for awarding $4.4 million (4.7% of its contract dollars) to SDVOSBs in FY2006;

v. Region 7 was recognized for awarding $3.9 million (11.3% of its contract dollars); and

vi. EPA's OSDBU was recognized for increasing opportunities for veterans at EPA, noting that EPA awarded a mere 0.08% of its contract dollars to SDVOSBs in FY2004, tripled that percentage to 0.24% in FY2005, and increased it exponentially by an additional 585% (to 1.64%) in FY2006.

EPA, as most federal agencies, is interlinked with FPDS-NG, which enables the timely submission of appropriate goaling data. As noted in the response below, at the end of each fiscal year, OAM works with the procurement personnel to finalize actions in ICMS/FPDS-NG to ensure all required data to be included in the end-of-year summary reports to be submitted to SBA.

7) Does the agency have a process to ensure small business data is accurately reported in FPDS-NG?

EPA's Office of Acquisition Management (OAM) has a process in the Agency's contracting writing system (ICMS) that identifies incorrect or rejected data. When any incorrect or rejected data is identified, the Contracting Officer inputs a help desk ticket to get support to resolve the problem. OAM works to ensure all data is accepted. EPA has a process in our simplified acquisition system (SPEDI) to ensure that the correct data on all small business categories in the system is directly linked to the Central Contractor Registry (CCR) and the information of the firm in CCR is automatically populated in the FPDS-NG data to ensure accuracy of the data.

Annually, at the end of each fiscal year, OAM works with the procurement personnel to finalize actions in ICMS/FPDS-NG to enable all required data to be included in the end of the year summary reports.

8) Does the agency enforce small business subcontracting plans and meet subcontracting goals?

EPA's OSDBU actively enforces subcontracting plans. We review and analyze subcontracting plans received from the Contracting Officers for procurement actions to ensure compliance with the Agency's stated subcontracting goals. Plans that do not meet or adhere to the Agency's goals are deemed unacceptable and returned to the Contracting Officer with a written analysis of the areas where the contractor fell short. Contracting Officers have been instructed to electronically submit to OSDBU a copy of each approved subcontracting plan. We have established a database of the subcontracting plans, which has enabled our office to cross-check the approved subcontracting plans with the eSRS summary information submitted.

Each subcontracting plan reviewed by OSDBU includes a reminder to the Contracting Officer to have the contractor "submit verification from the actual subcontractors performing the tasks and to provide the amount of work they are proposing under the requirement." Contracting Officers are advised to "monitor the total dollars expected to be subcontracted" and to include "the liquidated damages clause . . . in the forthcoming contract to cover periods where [the contractor] does not meet its goals."

The summary reports submitted via eSRS are compared with the information submitted in the approved subcontracting plans. Those firms that submitted summary reports that did not meet our subcontracting goals as approved in the subcontracting plans are rejected and were informed which specific socioeconomic categories they failed to achieve. They were asked to address the deficiencies and provide a plan of action.

We have drafted a letter that will be sent to offending contractors, requesting that they meet with our office to address continued and repeated failures to meet their subcontracting goals. We are currently assessing and determining if there are trends that must be addressed and will begin this process during the first quarter of FY2008. At that time, we will have enough data from eSRS to sufficiently perform a trend analysis.