Technical Meeting on HCFC Phase-Out
5-6 April 2008, Montreal, Canada
MEETING MINUTES

This document provides a summary of the presentations made at the Technical Meeting on HCFC Phase-Out, held in Montreal, Canada from 5-6 April 2008. The first day of the meeting began with an opening session with presentations focusing broadly on the challenges to HCFC phase-out, followed by technical plenary sessions on commercial refrigeration, small/medium air conditioning and heat pumps, other refrigeration and air conditioning applications, and large air conditioning. The second day of the meeting opened with a summary of the previous day's presentations, then continued with technical presentations on the foams sector, presentations from the Implementing Agencies on strategic and policy issues, and a final wrap-up of issues covered throughout the meeting. A summary of each presentation is provided below, followed by a brief synopsis of the question and answer period conducted during each session. All presentations are available in full as part of the Technical Meeting proceedings.

5 April 2008 (DAY 1)

Plenary: Opening Session

Mr. Thomas Verheye of the European Commission, Environment Directorate-General, and Mr. Mark Wagner of ICF International opened the meeting with welcoming remarks.

Mr. Marco Gonzalez, Executive Secretary of the Ozone Secretariat, spoke on the challenges and opportunities ahead in phasing out HCFCs and stated that continued efforts are critical to ensuring markets are transitioned. Mr. Gonzalez emphasized that only through cooperation between Parties, engagement with industry, and the participation of civil society will the global commons be protected.

Dr. Lambert Kuijpers and Dr. Paul Ashford of the Technology and Economic Assessment Panel (TEAP) (however, noting that they were speaking as private persons, not as TEAP) gave an overview of the challenges implicit in complying with Decision XIX/6, noting that part of the challenge is that HCFCs are used in both legacy applications as substitutes for the phase-out of other ODS, as well as in new applications. Drs. Kuijpers and Ashford also discussed projected growth in HCFC consumption and emissions. To achieve reductions, they suggested that several aspects needed to be considered: focusing on high ODP consumption first, selecting low GWP solutions preferentially, and focusing on markets with high consumption. They also stressed that servicing must be addressed early.

Ms. Maria Nolan, Chief Officer of the Multilateral Fund, thanked the European Commission for organizing the meeting and noted that she hope that the information from the meeting will assist developing countries. Ms. Nolan noted that the 19th MOP was a landmark in setting a new accelerated global agenda for HCFCs. She spoke on the challenge that remains to phase-out HCFCs and mentioned two discussion papers prepared by the MLF Secretariat for the 54th Meeting of the Executive Committee: one providing preliminary analysis on cost considerations for the financing of HCFC phaseout (UNEP/OzL.Pro/ExCom/54/54), and a second providing draft guidelines for the preparation of HCFC phase-out management plans (UNEP/OzL.Pro/ExCom/54/54). Both papers are available on the MLF Secretariat Web site at: http://www.multilateralfund.org. Finally, Ms. Nolan expressed her confidence that industry will work innovatively to rise to the challenge.

Mr. Husamuddin Ahmadzai of the Swedish Environmental Protection Agency discussed some challenges and cautions associated with the HCFC phase-out, including that 70-80% of HCFCs could be replaced with high global warming potential (GWP) gases if action is not taken. Mr. Ahmadzai suggested that signals are needed to dissuade use of HFCs, such as through national regulations, MLF funding provisions, and other approaches.

Technical Case Studies I: Commercial Refrigeration
Moderator: Stephan Sicars, Multilateral Fund Secretariat

In this session, speakers described alternatives to HCFCs for use in new and existing (retrofit) commercial refrigeration systems.

Dr. Reiner Tillner-Roth of Epta described the retrofitting of HCFC-22 systems in German supermarkets with R-422D. Dr. Tillner-Roth indicated that retrofits were conducted quickly without business interruption or additional investment, and resulted in energy advantages and a lower discharge temperature (for longer compressor and components lifespan).

Dr. Mack McFarland of DuPont Fluoroproducts addressed the benefits of retrofitting commercial refrigeration equipment. Dr. McFarland suggested that in certain cases, retrofits may be required to avoid premature obsolescence of equipment, and identified a number of alternative refrigerants (R-417A, R-422A, R-422D, and R-437A) that might be used for retrofitting. Dr. McFarland also outlined other considerations for retrofitting equipment, a decision tree process for selecting alternative refrigerants, and the energy efficiency and capacity benefits of alternatives.

Mr. Álvaro de Oña, of Shecco, talked about the potential for use of CO_2 (R-744) in supermarket refrigeration on behalf of the Green Cooling Council. Mr. de Oña discussed the advantages and disadvantages of R744 cascade systems, which have been installed in Australia, and R744 transcritical systems, which have been installed in Europe. R744 refrigerant is inexpensive, widely available, and shows promising results in terms of energy efficiency. However, installation costs are still higher and certain technical challenges remain.

Mr. Heinz Jurgensen of Danfoss CompressorsGmbH discussed the use of propane (R-290) as a replacement for HCFC-22 in commercial appliances. Mr. Jurgensen noted that propane is available and cheap, provides good performance compared to HCFC-22—especially in warm climates—and is environmentally friendly. To address flammability and safety issues, reduced volumes of propane can be used in systems and electrical parts may need to be moved or modified. Regarding costs, Mr. Jurgensen noted that safety requirements result in only a slight cost increase.

During the question and answer period, the following points were clarified:

- Dr. Tillner-Roth indicated that Epta has electronic systems in place to monitor temperature and other system conditions in order to optimize operations, but whether they are used depends on the customer and market.
- Dr. Tillner-Roth stated that a propane drop-in into an HCFC-22 system would require a system re-design (i.e., significant modification of equipment), and thus would not be a real retrofit. Dr. McFarland added that there may also be safety aspects to consider when using propane as a drop-in replacement, since HCFC-22 equipment may not be designed to operate with a flammable agent.
- Dr. McFarland indicated that refrigerant leakage must be addressed no matter what refrigerant is used—HFCs or natural refrigerants. Lifecycle analysis should be used on a case-by-case basis to evaluate the net impact of higher GWP HFC blends with higher energy efficiency improvements.
- Dr. Tillner-Roth stated that Epta has built only one or two propane systems to date and has not compared R-422D to propane directly. However, he suggested that the performance of R-422D and propane would be similar, although the cost of propane would be greater.
- Mr. de Oña noted that the leakage rates in newer CO_2 systems have been reduced,, but no specific data are yet available to comment on leakage rates in hotter climates.
- Mr. Jurgensen clarified that compressors have been designed to operate with pure propane, so the lifetime is as long as HFC-134a or R-404A compressors and like them, depends on the compressor design and oil selected. Almost all HC units are factory-made, plug-in units.
- Mr. Jurgensen noted that for hydrocarbon refrigerant systems, significantly more volume must be pumped when using isobutane, so propane generally is used because it has the same capacity with greater pumping volume flow.

Technical Case Studies II: Small/Medium AC & Heat Pumps

Moderator: Roberto de Aquiar Peixoto, Maua Institute of Technology (Brazil) and Coordinating Lead Author of AC Chapter of IPCC/TEAP, 2005

In this session, speakers addressed issues related to the availability and feasibility of alternatives in small and medium air conditioning systems and heat pumps.

Mr. Hideto Nakao of Mitsubishi Electric presented on compressor reliability of HFCs in AC units. Mr. Nakao discussed the manufacturing cost increases from shifting from HCFC-22 to R-410A, as well as the advantages, including better performance by preventing refrigeration oil deterioration and sludge generation.

Mr. Yasutaka Yoshida of Hitachi Appliances discussed high efficiency technologies for small and medium AC units using R-410A (an HFC refrigerant blend), including optimizing specifications for compressors, heat exchangers and refrigeration cycles, as well as conversion of assembly lines to produce equipment designed for

use of HFC-based refrigerants. Mr. Yoshida noted that some component dimensions can be more compact, resulting in a lower cost-ratio for HFCs versus HCFC-22.

Mr. Shigeharu Taira of Daikin Industries discussed the development of high temperature water heaters using CO_2 heat pumps, including the development of a swing compressor and water heat exchanger to meet the properties of CO_2. Mr. Taira described the advantages of CO_2 water heaters, including that they can heat water up to 90°C without a heater, and that they heat water at night when electric power is less expensive, resulting in a lower running costs. Mr. Taira also outlined next steps for the development and commercialization of next-generation of CO_2 water heaters.

During the question and answer period, the following points were clarified:

- Mr. Nakao clarified that ether and esther lubricating oils have both been used in Japan, but ether was chosen by Mitsubishi Electric because it does not interact the way that esther does.
- Mr. Nakao also indicated that although R-410A is generally more expensive than HCFC-22, the material costs to produce R-410A equipment are lower, since the dimensions are smaller (i.e., less metal is needed to create the equipment).

Technical Case Studies III: **Other Refrigeration/AC**
Moderator: Christianna Papazahariou, Secretary General of ECSLA

During this session, speakers discussed options for transitioning other types of refrigeration and air conditioning end uses.

Mr. Holger König of Jäggi/Güntner spoke about heat exchangers for natural refrigerants in high temperature conditions. Mr. König compared the energy efficiency and costs of heat exchangers for HCFC-22 to natural refrigerants and described a number of practical experiences with natural refrigerants. He also described the different substances that are appropriate for different operating methods, and the material for refrigerant-carrying tubes that is suggested for each application. Mr. König also emphasized the need to have well-educated and trained personnel to deal with equipment-containing natural refrigerants.

Mr. Daiki Shiomi of Sanyo Electric Company discussed CO_2 in vending machines. Mr. Shiomi noted that advanced technologies are required for compressor and refrigeration systems, but that CO_2 is a more environmentally friendly refrigerant than HCFCs or HFCs. Mr. Shiomi described the CO_2 compressor and refrigeration cycle, and noted that CO_2 systems were found to consume less energy than R-134a in tests. Today, more than 30,000 CO_2 vending machine systems are installed in the Japanese market.

Mr. Bruce Peak of the Energy Resources Group (ERG) discussed retrofitting large AC systems with hydrocarbons. Mr. Peak described the general process for HC conversions, as well as ERG's successful track record for retrofitting systems that have resulted in significant energy savings in diverse Article 5 countries. ERG customers typically pay up front, or the project is funded by ERG taking a percentage of the energy savings over a fixed period.

During the question and answer period, the following points were clarified:

- Mr. König clarified that the cost analysis of the heat exchanger versus HCFC-22 was theoretical, not based on real life experience.
- Mr. König noted that for hot climates and high humidity, heat exchangers will look different; some types cannot be used in areas of high humidity (e.g., hybrid coolers).
- Mr. König indicated that micro-channel has great potential, especially with respect to CO_2 in small systems (e.g., automotive), but problems with high pressure are not easy to resolve in large systems.
- Mr. Peak stated that ERG has considerable insurance for safety concerns, including upwards of $10 million product coverage and liability.
- Mr. Peak noted that ERG, together with ExxonMobil developed a single-molecule oil that outlasts any other by three times and results in significant energy savings. Mr. Peak reported that the oil can be used with any known refrigerant and can bring equipment that is 40 years old back to working capacity.
- Mr. Peak clarified that average energy savings from converting to hydrocarbons are about 17%; the higher bound of 72% energy savings are associated with locations where equipment is significantly run-down and is brought back up to operation.
- Mr. Peak stated that ERG is marketing in Australia -- building their network with a servicing company that now has a distribution capacity; however, Mr. Peak stated that he believes that Singapore is a better location than Australia for access to raw materials and blending.

Technical Case Studies IV: Large AC

Moderator: Dave Godwin, U.S. Environmental Protection Agency

In this session, speakers addressed the technical feasibility of alternatives to HCFCs in large air conditioning systems. One scheduled speaker, Mr. Todd Brown from McQuay, was unable to attend, but Mr. Brown's presentation is available, together with all other presentations, as part of the Technical Meeting proceedings.

Mr. John Ansbro of Johnson Controls spoke on ammonia screw chillers. Mr. Ansbro described the advantages of ammonia, including that is inexpensive, leaks are easy to detect (because of the pungent odor), and has better cycle efficiencies, as well as the disadvantages, such as the fact that it is incompatible with copper, flammable, and toxic in low concentrations. Mr. Ansbro noted that the European chiller market is heavily ammonia based, but also noted that there are ammonia chiller installations in the United States.

Mr. Jeff Moe of Trane discussed HFC-134a helical rotary chillers. Mr. Moe suggested that service infrastructure, capacity and supply chain development, and technology transfer are important for a smooth transition away from HCFCs. Mr. Moe indicated that Trane considered non-HFC refrigerants, but that these options have lower efficiency or raise safety concerns (especially hydrocarbons and ammonia). Mr. Moe noted that there will be a performance/cost penalty moving from HCFCs to HFCs, but this can be offset by optimizing non-refrigerant technologies, like compressors.

During the question and answer period, the following points were clarified:

- Mr. Ansbro clarified that ammonia chillers could be suitable for tropical countries. Ammonia cooling plants (but not chillers) have been installed in a Gulf country. Cooling plants require a larger capital investment.
- Mr. Ansbro indicated that ammonia systems have been used for district cooling in Chicago, but the issue is with a large charge of ammonia in densely populated areas because if it is released, it tends to move in clouds.
- According to Mr. Ansbro, ammonia-based chillers are more cost-effective than HFC chillers at about 250 tons, but Johnson Controls has installed systems as small as 100 tons, as well as very large systems. Ammonia chillers are about $300-$350 per ton, for systems that are 400 to 500 tons or more.
- Mr. Ansbro clarified that most ammonia acute exposure incidents are due to some other system failure, for example, an ammonia release in a plant in Arkansas recently was caused by a fire that carried over to the ammonia plant. Eurammon would be a good resource for inquires on safety issues.
- Mr. Moe declined to discuss the use of HCFC-123 as a refrigerant in chiller applications, noting that it was a competitive issue in the marketplace. (During the plenary on Day 2, Mr. Moe was briefly given the opportunity to clarify these remarks regarding HCFC technologies, in particular, noting that Trane is still strongly supportive of HCFC-123 in centrifugal chillers and will continue to supply the Article 5 market with such chillers in future. Because his presentation focused on transition to HFC-134a helical rotary chillers, he did not at that time want to divert the discussion by discussing legacy HCFC-based systems.)
- Mr. Moe noted that chillers represent a small segment of the atmospheric concentrations of HFC-134a. There is the option to move to zero GWP fluids, but with energy losses, the GWP gains are lost (i.e., from a TEWI perspective, it's a net impact of about zero). For chillers, about 95% of the TEWI is driven by energy consumption. Mr. Moe noted that an incidence rate of 0.5% from ammonia chillers was too high from Trane's perspective. Mr. Moe also pointed out that less than 1% of the market today is hydrocarbon and the percentage for ammonia is in the low to mid single digits.
- Mr. Moe clarified that near-term compliance actions include compliance with the 2013 cap and 2015 reduction. Rotary chillers are only 5% of the AC market, so they aren't going to achieve the entire compliance for a country, but may be able to contribute with "best" solutions.

6 April 2008 (DAY 2)

Plenary

Mr. Mark Wagner of ICF International opened the second day by summarizing what had transpired on Day 1 and introducing the activities for the second day. He commented on the fruitful discussion from the first day's sessions and emphasized the variety of substitutes and alternatives across sectors, the many innovations currently available, as well as those in the pipeline. He also emphasized that countries will need to actively investigate which options will be best for them, considering their needs, and in light of safety and environmental considerations. Finally, he noted the spirit of the first day's discussion, which underscored that successful HCFC phase-out will depend on 1) an intention to transition promptly, 2) the technical capabilities to affect change, and (3) economic incentives to do so.

Ms. Pamela Mathis of ICF International noted the successful efforts made to develop this workshop agenda to meet the needs of Article 5 participants by ensuring content that is technical and practical, captures global perspectives and experiences, and provides balanced coverage of HFCs and natural alternatives. Ms. Mathis encouraged participants to complete and submit evaluation forms, to provide EC with an understanding of whether the workshop met stakeholder needs and expectations, .

Technical Case Studies V: Foams
Moderator: Mike Jeffs, ISOPA, Lead Author of 2006 FTOC Report

During this session, speakers focused on feasible alternatives to HCFCs in the foams sector.

Mr. Paulo Altoe of Dow Latin America spoke about transitioning polyurethane appliance foam. Mr. Altoe noted that energy efficiency, environment and regulations, and cost and productivity are the driving forces for these foams. Mr. Altoe traced the history of transitions in PU appliance foam blowing agents, and provided a diagram for considering different aspects of the transition from HCFCs to HCs or HFCs from a practical perspective—giving consideration to flammability, cabinet characteristics, and costs. Mr. Altoe concluded that HFC-245fa was preferred for energy efficiency and non-flammability, but has a high cost and high GWP; HCs are preferred for environmental impacts and low GWP, but with less impressive energy efficiency impacts.

Dr. Enshan Sheng of Huntsman Polyurethanes (China) discussed the phase-out of HCFCs in rigid polyurethane foam applications in China. Dr. Sheng noted that pentanes currently dominate the appliances market in China, accounting for 50% of PU rigid foam in China, although HCFC-141b is still used due to high conversion costs and safety issues. Dr. Sheng noted that HFCs pose a significantly higher conversion cost than HCs. In other rigid foam applications, however, such as reefer containers, spray foam, pipe, and sandwich panels, HCFC-141b still dominates, although water is also used in pipes and sandwich panels. Major challenges include the high capital investment and safety issues for HCs, high blowing agent costs of HFCs, and poor thermal insulation and adhesion for water.

Dr. Ulrich Seeseke-Koyro of Solvay Fluor addressed technical, economic, and ecological implications of replacing HCFC foaming agents. Dr. Seeseke-Koyro discussed the thermo-physical properties of zero ODP alternatives to replace HCFC-141b, including lambda values, diffusion characteristics, and performance. HFC Solkane 365/227 can be used in spray foam, reefer containers, insulation panels, sandwich panels, appliances, and other foam applications. Dr. Seeseke-Koyro noted that HFC-365mfc offers good dimensional stability and compressive strengths, enhanced insulating performance, and lower GWP, and can be used in insulation panels, sandwich panels, and appliances. Dr. Seeseke-Koyro also spoke about converting production facilities from HCFC-141b to HFC-365mfc/227ea, and the economic and environmental aspects of converting to an HFC blowing agent.

Mr. Rolf Bohländer of Hennecke and Mr. Jens Kompe of KraussMaffei discussed replacing rigid foam manufacturing equipment in Article 5 countries. Mr. Bohländer and Mr. Kompe noted that while pentane mixed with air can be an explosive mixture, explosion proofing can be achieved with relatively simple safety measures. In designing a plant for processing pentane as a blowing agent for rigid polyurethane, the following are required: pentane and polyol storage, a premixing unit for polyol and pentane, a metering unit for metering and mixing polyol/pentane and isocyanate, and a working and foaming area. Mr. Bohländer and Mr. Kompe discussed the design and cost implications of these components. Gas detection systems and mould inertisation with nitrogen were also addressed. In addition, Mr. Bohländer and Mr. Kompe provided examples of retrofits that have been undertaken, such as in Chile.

During the question and answer period, the following points were clarified:

- Mr. Altoe clarified that when moving to cyclopentane, costs can vary from US$800,000 to US$3 million to modify a plant to produce 1 million refrigerators per year.
- Mr. Altoe stated that HFC-245fa is produced in China; China is ready to produce 20,000 tons per year and is already supplying the Chinese market.
- Dr. Sheng confirmed that HFC-365 is more expensive than HFC-245fa because of supply/demand dynamics in China.
- Dr. Sheng noted that the lambda for iso-butane isn't measured. Iso-butane isn't used very much and when used as a co-blowing agent, it does not contribute to the insulating property.
- Dr. Sheng stated that in the EU, reefers are starting to transition into HFC-227ea and other alternatives, which is expensive but companies have no choice.
- The country representative of Sweden clarified that HFC-245fa is not prohibited in Sweden.
- Mr. Bohländer and Mr. Kompe noted that the cost of ventilation for wet and dry processes varies on a case by case basis.
- Dr. Sheng noted that mineral oil and glass fiber are often used in China, but this option has limitations. Over time it can sag, and the insulation value is not as good as polyurethane. For existing buildings, polyurethane has unique advantages (e.g., adheres well to substrate, insulates well, is sustainable in the long term), but the cost is a bit higher.
- Dr. Jeffs noted that several foams types were not covered in this technical session, including XPS, integral skin foam, and methyl formate, because of time constraints. Methyl formate is discussed in the 2006 FTOC report and is one of several alternatives under evaluation, especially for integral skin. Mr. Altoe noted that methyl formate formulations require more water, which means that it has poor insulation performance and needs to be more dense, making the thickness unfeasible for appliance foams.
- Mr. Altoe clarified that pre-blending of hydrocarbon into polyurethane systems is possible but not used currently. This approach does not eliminate the safety risk of processing in the foams; rather, while it may facilitate one step in the processing of the foams, blending HCs constrains the insulation, and would result in additional costs associated with the transportation of the pre-blended formulation.
- One participant noted that many SMEs face phase-out issues in XPS; this transition deserves additional attention. Mr. Altoe noted that Dow produces polystyrene with CO_2 or butane.
- It was clarified that the escape of blowing agent in foams is a question of aging. Blowing agents in closed-cell foams are expected to stay in for a long time, but diffusion does occur. Pentane has a lower diffusion coefficient than HCFC-141b. The thermal conductivity of aging does change over time but is more dependent on the substrate.
- Dr. Seeseke-Koyro noted that some companies are specializing in recovering foams and blowing agents, and that Solvay has a burning facility where HFCs are destroyed and fluorine is recovered for use in other products. Polyurethane foams are also being recycled into other products.

Project Implementation

Moderator: Thomas Verheye, European Commission

During this session, representatives from the four Implementing Agencies discussed issues related to lessons learned from the phase-out of CFCs, strategic challenges for the HCFC phase-out, and recommendations for a way forward.

Dr. Suely Carvalho of UNDP discussed the technical and economic aspects of an accelerated HCFC phase-out, emphasizing that time is of the essence. Dr. Carvalho noted that emerging HCFC alternatives need to be validated in an Article 5 country context through pilot (demonstration) projects, that individual country phase-out strategies are required, and that proper sequencing and prioritization of phase-out activities are critical to success.

Mr. Blaise Horisberger of UNEP addressed factors to consider during project implementation, such as the unique challenges of countries phasing out small volumes of HCFCs. He also identified lessons learned from implementation including process, technical, and access to infrastructure perspectives. Mr. Horisberger highlighted opportunities for phase-out, including developing practical methodologies for selecting alternatives with minimal climate impacts; promoting replacement of HCFCs with climate-friendly, ozone-friendly, and energy-efficient equipment; encouraging building design that avoids/minimizes mechanical refrigeration; and expanding the reach of natural refrigerants.

Mr. Sidi Menad Si-Ahmed of UNIDO provided an overview of UNIDO's focus on refrigeration phase-out and technology transfer and identified major issues to be addressed in order to achieve progress in phasing out HCFCs. Mr. Si-Ahmed also outlined a way forward that included surveying the baseline situation, studying new

alternatives, implementing demonstration projects, preparing prioritized sectoral phase-out strategies, harmonizing HCFC demand and supply, utilizing the service sector for future needs of HCFCs, and working closely with the international community to finalize policy and funding issues.

Mr. Steve Gorman of the World Bank identified lessons learned from the CFC phase-out, and addressed strategic concerns in the HCFC phase-out—including the higher volume of baseline consumption of HCFCs but lower ODP impact compared to CFCs, and the implication of this relationship for the conversion costs on a per kilogram basis. Mr. Gorman also explored the possibility of linking the HCFC phase-out to funding sources other than the MLF, such as the GEF, CDM, and the private sector. Finally, Mr. Gorman outlined a way forward for developing HCFC phase-out strategies in the short- and medium-term.

During the question and answer period, the following points were clarified:

- Mr. Horisberger stated that LCCP analysis might be the ideal approach, but it is difficult to implement upfront as a means of choosing a technology (due to cost and time). Instead, by focusing on the alternative with the lowest direct climate impact and by optimizing energy efficiency, a good LCCP is probably achieved. Mr. Rajendra Shende of UNEP stated that LCCP analyses are difficult and suggested that further analysis be undertaken to articulate those challengess.
- Mr. Si-Ahmed clarified that, although demonstration/pilot projects can take several years and Article 5 countries must meet the HCFC freeze by 2013, such projects will help lead to phase-out (i.e., contribute to meeting the freeze). Investment activities might also be run in parallel with phase-out management plan preparation to speed up the process. Mr. Veenendaal stated that pilot projects are important for demonstrating commercial viability, since not all technologies are available in all countries. While they may be expensive, the knowledge gained through them often leads to cost-savings in the end.
- Regarding the collection and treatment of HCFCs, Mr. Horisberger noted that there will be a huge need to recover and reuse HCFCs (at least HCFC-22) to meet servicing needs, and that destruction might focus on high-ODP substances. Dr. Carvalho stated that UNDP believes that there are benefits from treatment of unwanted ODS, but that it is currently an unfunded mandate.
- Mr. Gorman clarified that about 50% of the past cost of conversion (i.e., from CFCs) was being absorbed by enterprises across World Bank projects.
- One meeting participant suggested that a unified and comprehensive code of practice covering prioritization of issues, alternatives and technologies that are available commercially, safety procedures of those alternatives, and the role of NOU and stakeholders in accelerating the phase-out would be a helpful outcome of this meeting.
- One meeting participant expressed a hope for better coordination between IAs and consultants appointed by IAs, and suggested that IAs focus on the limited timeframe for compliance.
- A representative from Greenpeace urged the Parties to act with a greater sense of urgency, and to adopt a presumption against HFCs and not fund HFC projects where other options are available.

Wrap-Up

Mr. Thomas Verheye of the European Commission reminded participants that the objective of the meeting was focused on exchanging technical, hands-on information based on industry case studies, and stated that he felt that objective had been met. Mr. Verheye suggested that due to the nature of the technical meeting, there will be a need to reflect on what has been learned and to follow up and continue work in each participant's own country to make use of the information; agencies will be an important resource for this continued work. Mr. Verheye also noted suggestions that action on demonstration projects should not be delayed.

Mr. Mark Wagner of ICF International noted some overall findings from the technical case studies, including that there are a wide variety of HCFC substitutes available today, and many more that will become available in future. Mr. Wagner concluded that the technical feasibility of substitutes varies by access to technologies, country circumstances, local climate conditions, costs, and a host of other considerations. Moving forward, Mr. Wagner stated, priorities need to be understood; knowledge management will be important; networks need to be improved; energy efficiency, containment, and destruction of decommissioned fluids will be important; interaction with other funding mechanisms should be investigated; and ongoing training and technical assistance will be needed.