Input to UNFCCC Secretariat
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Baseline Scenarios for Destruction of HFC-23 in the HCFC-22 Industry

For the majority of global HCFC-22 production facilities, the production of unavoidable co-product HFC-23 occurs at a rate amounting to 2-4% of the HCFC-22 produced. Manufacturer efforts are directed to minimize this formation as it represents a costly yield loss and the resulting HFC-23 is usually vented. While it is possible to capture this material, this proves difficult due to its extremely high vapor pressure.

The amount of HFC-23 produced is a function of the amount of catalyst used and its condition, the temperature of the reactor and the pressure of reaction. At higher temperatures and pressures, more HFC-23 is produced, while at milder reaction conditions, less is produced. It is unfortunate that the desired HFC-23 minimization occurs when the productivity of the reactor (space-time-yield, STY) is reduced.

Baseline Scenarios:

The performance of an HCFC-22 reaction system will vary based on the amount of catalyst used, its manufacturer and specifications, the condition of the catalyst at that time as well as the reaction conditions such as temperature and pressure. The condition of the catalyst can be affected by impurities introduced by raw material feeds. The following are optional approaches that could be considered by UNEP for CDM baselines:

- 1. Establish the baseline at the lowest observed level:
  DuPont has indicated that their system has performed in such a way as to enable them to achieve an HFC-23 production level of less that 1.4%. It suggests they have operating flexibility not available to other producers. The DuPont production system is massive. Their single line production unit at Louisville, KY makes them the largest global HCFC-22 producer. This oversize unit allows them the luxury of operating at the low temperature and pressure conditions that others cannot enjoy while still being able to dominate global supply. They have the ability to have low STY and still operate profitably due to overwhelming benefits of scale and the fact that their old investment is fully depreciated. Their proposal to establish this low level as a baseline is a way to institutionalize financial benefit over the rest of the world's producers by requiring others to destroy more HFC-23 without allowing others the associated benefit of a baseline appropriate for individual facilities.

- 2. Establish the baseline at historical levels for the site in question:
  The baseline for a site can be set by examination of historical data over a set period of time, e.g., past two years, and utilize that level as the baseline. This allows for the reality that all systems are unique and that there is a realistic tradeoff between HFC-23 generation rate and unit productivity. It requires

that such data are available and have been collected in a manner consistent with IPCC protocol.

- 3. Establish the baseline by measurement of current operation:
  In the event historical data are absent or not reliable, proper protocols can be establish to make on-line measurements of system performance utilizing reasonable operating criteria of production rate and conditions. This again is a direct measure of actual system performance rather than comparison with a standard that cannot be achieved by most producers.

- 4. Utilize default HFC-23 co-production rate.
  If it is not possible to measure HFC-23 production rate from a facility, one could resort to a default rate estimate. It is not appropriate to utilize one of 1.4%; rather, one of 2-4% would be more representative of the global condition. A survey of current HCFC producers might be illustrative of HFC-23 production percentage before efforts to sequester or destroy by-product could suggest a good default level. One would expect 3% might be a reasonable average. Selection of such a level should take into the account that the majority of HCFC-22 producers do not have the resources DuPont can call upon to have a successful business and produce HCFC-22 with an HFC-23 production rate of 1.4%.

Industry Practices in Handling HFC-23

Venting:

The most common practice in the industry is to produce HCFC-22 to maximize STY while accepting that there is a yield loss and cost impact due to HFC-23 formation. This HFC-23 by-product is commonly allowed to pass through the refining system and to leave the production facility as a vapor vent to the atmosphere.

Capture and destruction:

It is possible to capture a portion of the HFC-23 vent stream that would otherwise vent. This is achieved by keeping the entire system under high pressure and utilizing extremely low temperature coolant to condensation equipment in an effort to condense and remove HFC-23 in a segregated liquid phase. The proportion that can be captured in based upon the pressure (higher is better), the coolant temperature on the vent condenser (the colder the more that can be captured) and the level of non-condensable gases within the system that must exit. The amount collected can then be transported to a commercial destruction facility via rail or truck for thermal destruction. The remaining HFC-23 that cannot be condensed remains as a vented stream to the atmosphere.

Thermal destruction of vent gases:

This approach has the benefit of maximizing the destruction of HFC-23. The vent from the reaction and purification systems are directed to a thermal destruction facility where the destruction of HFC-23 is >99%. While the investment associated with a destruction unit is not excessive, it is then necessary to utilize a caustic scrubber to remove fluorine-containing vent gases from the vent stream and then to precipitate the resulting fluorides as a solid phase. They must be crystallized to be separated from the liquid phase, segregated and put into a chemical landfill. These are very high investment and high cost operations.

Project impacts on HCFC-22 availability

The requirement to capture/destroy HFC-23 for HCFC-22 producers will significantly add manufacturing cost and investment. This could be a deterrent to HCFC-22 production and investment, particularly for producers without current HCFC-22 investment or for developing countries. However, projects providing the ability to earn certified emission reduction credits (CERs) which can be sold, traded or bartered provide a significant positive impact to overcome the cost/investment hurdle.

In our opinion HFC-23 destruction projects have an unusual mutual benefit to the environment and to business because of the ability to capitalize on CERs. This will encourage manufacturers to produce HCFC-22 and to invest in and operate facilities designed to minimize HFC-23 emissions. This will assure long term availability of HCFC-22 to meet societal needs for refrigerants and other applications and as chemical building blocks for fluorochemical polymers in an environmentally sustainable manner.

Steven H. Bernhardt

Steven H. Bernhardt, PhD
Global Director Regulatory Affairs
Honeywell Chemicals