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FINAL REPORT ON THE EVALUATION OF CTC PHASE-OUT PROJECTS AND AGREEMENTS

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I. Executive Summary

1. The maximum allowable total carbon tetrachloride (CTC) consumption in 2005, after respecting the 85% reduction target, is 8,219.1 ODP tonnes for Article 5 countries. Within this total, 5,733.1 ODP tonnes are the target for the People's Republic of China if the recently changed baseline of 38,220.6 ODP tonnes is used (or 8,383 ODP tonnes if the former baseline of 55,891 ODP tonnes is used which would make the overall target for all Article 5 countries 10,824,0 ODP tonnes), and 1,725.8 ODP tonnes for India. The actual reported total consumption in all Article 5 countries in 2005 amounted to 2,809.7 ODP tonnes, including 1,060.3 ODP tonnes in China and 1,644.0 OPD tonnes in India. This indicates compliance for most Article 5 countries, which is an important achievement in view of the relatively late start of CTC projects and the challenging 85% reduction step without an intermediate freeze. However, 8 countries reported some excesses in consumption for 2005. The largest two are Mexico (61.4 ODP tonnes) and Pakistan (86.6 ODP tonnes), as set out in Annex I. The differences in baseline data reported for China in various documents and years need clarification but will most likely not affect the compliance status. Moreover, a large number of process agent applications are still counted in the 2005 data as feedstock and will need to be reported as controlled consumption when confirmed by the Parties. There are also some discrepancies between reported Article 7 data and trade data made available on the UN Comtrade website.

2. In 2005, preliminary analysis indicates that gross global CTC production appears to be some 176,000 tonnes, with 146,000 tonnes of feedstock use including for CFC production, 13,600 tonnes of process agent (PA) and solvent use, and around 16,500 tonnes of CTC being destroyed (estimates by Sherry Consulting).

3. Field case studies and verification reports indicated non-compliance with the Montreal Protocol and the Agreement phase-out targets for Pakistan, and compliance for China, the Democratic People's Republic of Korea and India.

4. Important policy measures have included the installation of import controls (and sometimes outright bans as in China) and corresponding training of customs officials, the issuing of quotas to CTC producers in countries with CTC production and the issuing in some cases of specific consumption or trading quotas. India treats all production that is not consumed as feedstock as a controlled use by default, whilst China sets strict controlled use allocations including zero quotas to new producers who are required to demonstrate full internal CTC absorption capability. In some countries (e.g. China, Romania) CTC solvent use has been banned totally. As of 2007, all CTC producers in China have zero production quota and can only sell to buyers with user licenses.

5. Awareness activities have included national Ozone Day celebrations, industry and public workshops and lectures, communications with the chemical industry associations and other related trade groups, TV and press coverage, and youth painting competitions. Information about alternatives to CTC solvent uses seems somewhat dated and does not always reflect newer regulations on chemicals that are regarded as being harmful to human health. The list of alternatives should be updated and standardized and should not include brand names.

6. In general, the verifications are well executed and the reports presented in time. However, it would improve transparency if verifications of the PA-I and PA-II agreements in China would be combined for future years. Marking all papers as draft or final and dating them would also be

helpful. The most important future issue will be the level of verification that will be achievable and affordable once the plans are formally finalized and funding ceases in 2009/2010.

7. Since there was no freeze period applying to CTC prior to the 85% reduction target in 2005, and the number of initially identified PA uses was limited, most users of CTC in other PA applications have only recently become aware about the requirements of the 2005 and 2010 reduction targets. There have been a number of delays in CTC conversion projects in the Democratic People's Republic of Korea (this will likely continue), Pakistan (which contributed to the 2005 non-compliance status) and India.

8. There are some sustainability issues in that, unlike other presently controlled substances, CTC production will continue and might further increase after the phase-out of controlled production and consumption in 2010. Furthermore, demand will progressively decline to a point where it will be lower than the minimum amount of CTC being co-produced. Selling CTC even at very low prices will still be more profitable than destroying it, with an ensuing risk of CTC being placed on the market without licenses. Such low prices could also result in illegal use of CTC by users, who see it as the best available PA or solvent option. Hence, ongoing monitoring systems will be vital. Other sustainability issues concern the potential influence of Decision XVIII/17 of the Meeting of the Parties, which accepted the reasoning that some apparent over-production of CTC could be stockpiled for future feedstock use. This could lead to some leakages of CTC for controlled uses if stocks are not strictly controlled, monitored and verified.

9. Finally, on sustainability, the building up of stocks or "banks" of CTC in 2004, as a safeguard against future supply shortages, could reasonably have been expected to lead to compliance in 2005. The real test might be in 2006 when the stocks are running out and the reality of reduced availability strikes home, as in the Democratic People's Republic of Korea. Similar problems may arise elsewhere but only data reported in 2007 will reveal this.

II. Background

10. The CTC sector evaluation is part of the 2006 Monitoring and Evaluation Work Programme. The desk study issued in March 2006 (document UNEP/OzL.Pro/ExCom/48/15) established an assessment of progress achieved based on project documents and on the progress and completion reports received. Case studies were subsequently prepared after field visits to PR the People's Republic of China, the Democratic People's Republic of Korea, India, and Pakistan. They are available on the Intranet of the Fund Secretariat (in the section 'Executive Committee, Evaluation, Evaluation Document Library') or at request as hard copies. Comments on the draft case studies and synthesis report received by the Ozone Secretariat, the Implementing Agencies and the Ozone Units of the countries concerned were taken into account in the final versions.

11. The evaluation focused on CTC used as process agents and on CTC production. The main question to be addressed was whether the Fund has the right portfolio and has taken the appropriate approach to facilitating achievement of the 85% reduction in 2005, as well as to consider the risks to sustaining the phase-out in the following years.

12. The CTC sector is unique in the sense that, at the time of inclusion in the Montreal Protocol (MP), most CTC use was not actually controlled under Protocol rules. The largest part of the volume produced at that time was consumed for feedstock applications, mainly for the

production of CFC-11 and CFC-12. Moreover, the number of controlled CTC uses became a moving target, as decisions of the Meetings of the Parties gradually recognized more process agent uses (decisions X/14, XV/6 and 7 and most recently decisions XVII/7 and 8). The 17th Meeting of the Parties also requested TEAP in decision XVII/6 to report on process agents to the 27th OEWG, and specifically on those listed in decision XVII/8 to the 19th Meeting of the Parties for further review. This has resulted in some delays in establishing the size of the CTC-consuming sector.

13. Another feature of CTC is that, although like the other controlled substances it can be made deliberately, it is also an unavoidable co-product of parts of chloromethanes production. It is cheap to produce, so its use particularly as a solvent in numerous small enterprises is very tempting. The juxtaposition of controlled and uncontrolled uses makes accurate monitoring and reporting difficult, and many existing licensing schemes were not designed to cover CTC. At the same time, it is the sector with the most advanced phase-out schedule. Unlike for CFCs and hydrochlorofluorocarbons (HCFCs), there was no period of freeze for either production or consumption of CTC between the entry in force of the Protocol and the first reduction step of 85% in 2005.

14. The implications of the inevitable co-production of CTC and the selective ban of CTC under the Montreal Protocol are that production of CTC will continue for legitimate feedstock demand beyond 2010. This could place considerable stress on sustaining the phase out of CTC in PA and in feedstock uses for production of CFCs, which could be produced illegally, particularly in HCFC/CFC swing plants. In this, the phase-out of CTC production is unique compared to the phase-out of production of other ODS, such as CFCs, or even methyl bromide which has dual purpose uses for controlled use and quarantine and pre-shipment (QPS), but does not have the complication of inadvertent production.

15. This uniqueness presents challenges to the national governments and industries in managing the CTC production phase-out in accordance with the Montreal Protocol. The economic development of the country may require an expansion in the production of methylene chloride and chloroform, which unfortunately increases the co-production of CTC. On the other hand, the phase out of CFC production has removed a major demand of CTC as feedstock. The dilemma that the government faces is whether it can stop the expansion of the chloromethanes industry when there is a demonstrated shortage in the supply of methylene chloride and chloroform because of the inevitable co-production of CTC in their manufacture, and the risk this may pose on its chance of compliance with the Montreal Protocol. Alternatively if it allows the expansion of the chloromethane industry, it has to find new feedstock applications to absorb the CTC to be co-produced. For the industries, the challenge is to comply with the CTC production quota for controlled use assigned by the Government while maintaining a viable business. This requires the exploration of new markets for CTC feedstock or moves to other business opportunities in the chemical industry.

III. Overview of Present Status

III.1 International Context

16. This chapter provides an overview of the CTC phase-out achieved, remaining consumption and risks for non-compliance in Article 5 countries, as well as production globally.

17. Worldwide use of CTC for PA/solvent applications was estimated at 13,600 tonnes in 2005 versus 34,000 tonnes in 2004. New producers of chloromethanes added more by-product capacity in 2005-2006 than that phased-out, but are required to facilitate destruction or to provide feedstock outlets.

18. As noted in the Supplementary Reader to the 2006 Desk Study, 11 countries/regions were producing CTC in 2004. This includes the European Union (EU) as one country/region, whilst within the EU there are five countries with CTC production. In 2004, the actual production of CTC is assessed at 184,000 tonnes globally, with some 14,500 tonnes being destroyed, and the consumption (meaning purchases and not actual use) consisting of 135,000 tonnes as feedstock, and 34,500 tonnes as process agent or solvent representing the controlled sector.

19. In 2004, global export trade in CTC was 40,600 tonnes, this being produced in EU, the United States of America (USA) and Brazil. CTC from the producing areas was exported to a large number of countries, the largest importers being India, Mexico, the Republic of Korea, Argentina, Venezuela and Romania. Many other countries have small imports of CTC. India's consumption of imported CTC, under its import policies, is verified as being all for non-ODS feedstock applications. Mexico, Argentina and Venezuela were operating CFC production plants in 2004 and the use of CTC is largely, and may be wholly, for feedstock. This will become more apparent as CFC production phases out. Romania's use is as process agent and is subject to an Agreement. In 2005 Brazil, having stopped CTC production, imported some material from USA (this being an internal transfer of CTC between branches of the same producer), verified as being for non-ODS feedstock in the manufacture of perchloroethylene.

20. In 2004, there were 31 plants globally producing CTC based on the chloromethanes process, 10 plants producing (or capable of producing) CTC on perchlorination plants, and one plant producing CTC by the carbon disulphide process. The minimum capacity to produce CTC from these units is assessed at 179,000 tonnes per year. This may also be expressed as the minimum inevitable co-production. Since the actual volume produced globally is assessed at 184,000 tonnes in 2004, this indicates that some CTC production is still deliberate.

21. In 2005, the only production unit for CTC in the Democratic People's Republic of Korea was closed and one dedicated CTC production line was closed in China with some additional capacity reduction measures, although some new capacity was established for CTC as a co-product from chloromethanes plants, including from one new producer. However, these plants do not obtain a production quota for CTC. At the end of 2005 the minimum capacity to produce CTC is assessed at some 150,000-160,000 tonnes per year. It is too early to definitively establish 2005 production and consumption volumes but preliminary analysis shows CTC gross production as 176,000 tonnes, with 146,000 tonnes of feedstock use including for CFC production, 13,600 tonnes for PAs and solvent uses, and around 16,500 tonnes of CTC being destroyed (estimates by Sherry Consulting).

22. In India, there will be one new producer in 2007 with an estimated additional 2,000 tonnes per year minimum CTC capacity, and in China there will be at least one additional new producer as well as additional chloromethanes capacity built by existing producers in 2006-2007, amounting to a minimum of 200,000 tonnes per year of chloromethanes with some 10,000 tonnes per year of CTC. In both countries, new plants are required to demonstrate that adequate provisions have been made to either consume or destroy co-produced CTC.

III.2 Summary of Case Studies

23. During 2006 missions were conducted (in chronological order) to Pakistan (CTC consumer by imports), India (CTC consumer, producer and current importer), the Democratic People's Republic of Korea (CTC consumer and former producer, no imports), and China (CTC consumer and producer, no imports) to evaluate the CTC phase-out agreements. These countries are the largest remaining CTC producers and users among Article 5 countries. They provide a good cross-section of CTC consumption across different applications, of ways that production controls have been affected, and of import management.

a) Pakistan

24. Pakistan has no production of CTC and all supplies must be imported. Imports of CTC in 2005, the first year of the required 85% reduction versus the 412.87 ODP tonnes baseline, were recorded by Customs as 136.5 metric tonnes (150.15 ODP tonnes) (sources: Ministry of Commerce, Customs division, and Verification Report of 2005 CTC Consumption in Pakistan, prepared by Geo-Hydro Consult, June 2006). The import volume reported as Article 7 data was 148.50 ODP tonnes. All imports originated in the Republic of Korea. With a maximum allowable consumption of 61.93 ODP tonnes, Pakistan was deemed to be in non-compliance with its 2005 allowable consumption under the Montreal Protocol. This non-compliance was noted by the 18th Meeting of the Parties which, in Decision XVIII/31, also noted Pakistan's plan of action to reduce CTC consumption to 41.8 ODP tonnes in 2006, as foreseen in the Sector Plan.

25. The 2004 verification report 2004 (Geo-Hydro) stated that, based on Ministry of Environment data, the 2004 imports of CTC were 752.07 ODP tonnes. With a maximum allowable consumption of 389.3 ODP tonnes, Pakistan was in apparent non-compliance with its 2004 allowable consumption under the Sector Plan, as again in 2005 (see above). The verification report notes that the phase out of 270 ODP tonnes of CTC has been achieved at 34 enterprises. The balance of the consumption is estimated by the verification report as some 60 ODP tonnes in the "informal" sector (the small and unidentified users) and residual 89 ODP tonnes of assumed exports to neighbouring countries, notably Afghanistan, without customs controls and records.

b) India

26. India produces CTC for CFC production, non-ODS feedstock, and residual solvent and PA applications. The capacity to produce CTC is less than market demand and India is a net importer, although imports are specifically controlled for feedstock use only. In 2005 imports were 17,200 tonnes and gross production by the three manufacturers was 19,200 tonnes. Based on the information from producers, the mission noted that the minimum capacity to produce CTC is 11,500 tonnes, indicating that at present there was no requirement to minimize output, and that the loss of profits assumed as a basis for allocating about 55% of total funding for the CTC sector plan to the three producers, has not yet occurred. A fourth manufacturer will begin full production of chloromethane in 2007 and this will generate some 2,000 tonnes of CTC, which is required to be destroyed or to be used as feedstock for non-ODS production.

27. In 2005, the first year of the required 85% reduction versus the 11,505 ODP tonnes baseline, the total consumption is reported as 1,643.95 ODP tonnes (Article 7 data) versus the maximum allowed consumption of 1,726 ODP tonnes. This reflects compliance and is a very

positive result of consistent policy development, enforcement and monitoring by the NOU and PMU as well as good implementation of the phase-out plan, with the World Bank and several cooperating agencies. However, the total sum of gross Indian production plus imports less feedstock use shows an apparent over-consumption of 811.8 ODP tonnes for controlled uses which was explained by the production of CTC being held in storage for use in future feedstock applications. This concept was accepted by Decision XVIII/17 of the 18th Meeting of the Parties, as India's monitoring system is tight, encompassing CTC producers, users and traders, and will thus most likely prevent any leakage from feedstock to controlled uses.

c) The Democratic People's Republic of Korea

28. The Democratic People's Republic of Korea has been a CTC producer until 2005, when as scheduled the plant at the 8th February Vinalon Complex at Hungnam City, with a nominal capacity of 2,300 tonnes per year, was closed down, having completed its 2005 permitted production of 174 tonnes (191.4 ODP tonnes). Imports have been banned since 2001 except under specific conditions.

29. The phase-out schedules under the sector plan and the Montreal Protocol were aligned until 2005 when as the first reduction step, 85% of CTC production and consumption have to be phased out. Thereafter the sector plan should bring about an advanced phase-out of CTC production and consumption. Specifically, the Democratic People's Republic of Korea will eliminate CTC consumption by the end of 2008 whereas the Montreal Protocol schedule allows for 92.8 ODP tonnes of consumption until the end of 2009. In 2005, the first year of required reduction versus the 1,285 ODP tonnes baseline, the total consumption is reported as 191.4 ODP tonnes (Article 7 data) versus the maximum allowed consumption of 193 ODP tonnes, or 15% of the baseline. This reflects compliance. It should be noted that the actual use of CTC by the enterprises was reported as 836 ODP tonnes, based on the permitted 2005 consumption plus stocks produced in 2004 (the "CTC bank").

30. In 2006, the stocks of CTC had been virtually depleted, but there are serious project delays in obtaining equipment, possibly due to non-ratification of the International Chemical Weapons Convention by the Democratic People's Republic of Korea (other countries which adhere to this convention are not allowed to export equipment enabling the production of chemical weapons to the Democratic People's Republic of Korea). This could result in some of the equipment never arriving in the Democratic People's Republic of Korea or not being allowed to be installed by the supplier. Two factories still have the equipment to use CTC for essential pharmaceuticals, and in addition the manufacture of fumigants could continue based on CTC. Imports of CTC in 2007 could enter the Democratic People's Republic of Korea up to the maximum allowed consumption of 77.8 ODP tonnes, and in 2008 up to 37.8 ODP tonnes according to the Plan. The Democratic People's Republic of Korea could slip outside the Plan by importing or producing additional CTC and still comply with the Montreal Protocol which allows annual imports and production of 192.8 ODP tonnes until the beginning of 2010 (15% of the baseline). However, this may risk non-approval of the funding for the last tranches of the phase-out plan.

d) The People's Republic of China

31. China produces and consumes CTC. There have been up to 17 CTC producers, but in 2006 there are only nine left, albeit of a much larger average size. Two phase-out programmes are in place. An initial (PA-I) process that dealt with all production as well as the CTC use in the

initially recognised 25 process agent applications, and the PA-II programme that covered the 13 newly recognised process agent applications as per Decision XV/7 of the Meeting of the Parties as well as any additional PA applications possibly discovered later. Since April 2001 an import ban has been in place and strictly enforced. Since 2006, deliberate CTC production has been phased-out, and the remaining CTC production will arise as a by-product from chloromethanes units.

32. Between 2003 and 2006 (planned) the total elimination of annual capacity to produce CTC is 35,974 metric tonnes. The rapid growth of chloromethane capacity, with the ramifications of inadvertent CTC manufacture, has been closely followed by the State Environmental Protection Administration (SEPA), initially by production and consumption quota allocations and more recently by strict requirements that producers should have the capability to manage their own CTC output either for internal non-ODS feedstock uses, by destroying it or by selling it to legitimate users with consumption quotas.

33. For 2005, the first year of the required 85% reduction of CTC production and consumption under the Montreal Protocol, China reported Article 7 data of 1,060.33 ODP tonnes of production versus a target of 1,754.5 ODP tonnes, and 1,060.33 tonnes of consumption versus a target of 5,733.1 ODP tonnes. China is therefore in compliance, and in fact has for the most part exceeded the required phase-out. This is an important achievement, thanks to stringent and comprehensive policies established and enforced by SEPA and the successful preparation and implementation of the PA-I and II agreements in cooperation with the World Bank. While unlikely to affect the compliance status, the changes of baseline data over the years and in different documents need to be clarified. It is also important to note that CTC consumption has not yet been verified for PA-II applications, and that this makes it difficult to align the data from the verification report for 2005 with the Article 7 data reported.

34. Under the sector plan (PA-I and production), verified production in 2005 was 33,080 ODP tonnes (after deducting 14,297 ODP tonnes for non-ODS feedstock and some newly identified PA applications, and 146.3 ODP tonnes of CTC destroyed). CTC use in CFC production was verified at 25,811 ODP tonnes, and 485 ODP tonnes were verified as PA-1 consumption. The production level, and that for PA-I, are both in compliance with the sector plan. Considering the verification details from the sector plan, the unaccounted balance of 6,784 ODP tonnes (33,080 tonnes of production less 25,811 tonnes of consumption in CFCs less 485 tonnes of use in PA-I) should represent CTC consumption in the PA-II sector, the verification of which is under preparation and scheduled to be presented to the 52nd Meeting of the Executive Committee.

III.3 Other Countries

a) Brazil

35. The Montreal Protocol baseline for CTC consumption in Brazil is 411.60 ODP tonnes and the 2005 target is therefore 61.74 ODP tonnes. Production of CTC in Brazil has been important with a baseline level of 11,629 ODP tonnes that was largely used for feedstock applications. This production has now ceased. (It might be noted that this was a technical cessation in that the technology used is perchlorination and the company concerned has committed to a 100% perchloroethylene cycle, but this does not mean that CTC cannot be manufactured).

36. 2005 imports of 800 metric tonnes (880 ODP tonnes) were for consumption as feedstock in the local perchlorination unit that means for non-controlled purposes. However, in 2006 there were requests for import allowances for a process agent use that was thought to have converted, and there is some ongoing use of CTC as well in a vinyl chain operation. This application was noted by the 18th Meeting of the Parties as process agent use depending on clarifying its actual consumption, but the same use in India is asserted as chemical intermediate. The Government timely discussed about these requests with UNDP and was advised not to allow any import licenses above the established compliance level. UNDP has subsequently informed that it has consulted the NOU on the status of the import licenses issued in 2006, since official Article 7 reporting data is not yet available. The NOU advised that it will be able to provide a status of the 2006 situation to the 51st Meeting of the Executive Committee.

b) Mexico

37. Article 7 data indicate a zero baseline for CTC and zero consumption in the period 2001-2005. However, in mid 2005 the Ozone Unit obtained a request for the import of 100 metric tonnes of CTC for use in chlorine tail gas treatment, which is an approved PA use. This newly identified consumption averaged over 78 tonnes per year in 2000-2004. It might be noted that Mexico was a CFC producer until mid-2005 and consequently imported large quantities of CTC as feedstock.

38. Decision XVIII/29 of the Meeting of the Parties accepted to change Mexico's baseline to 187.5 ODP tonnes. The same Meeting noted an Action Plan which will reduce CTC consumption from 89.5 tonnes in 2005 to 9.4 ODP tonnes in 2008 and to zero in 2009 (Decision XVIII/30).

c) Romania

39. Romania has a 372 ODP tonne baseline for CTC production. The recent CTC production phase-out agreement foresees a maximum annual production limit of 170 ODP tonnes of CTC between 2005 and 2007, after which production will cease. Romania had reported large amounts of feedstock production for exports which were deducted from their gross production figures to calculate the baseline. However, if the baseline figure is correct, maximum allowed production would be for 2005 until 2009 only 55.8 ODP tonnes instead of the 170 ODP tonnes foreseen in the phase-out programme which should be clarified. Production for 2005 was reported as 30.9 OPD tonnes, resulting in compliance with both the phase-out agreement and the Montreal Protocol reduction targets.

40. Of the two producers, one (Chimcomplex) will revamp a small chloromethane process which co-produces CTC mixed with chloroform to a nominal 40,000 tonnes per year chloromethanes plant which would have incineration facilities to consume the 2,000 tonnes per year co-produced CTC. Oltchim uses perchlorination technology which can nominally produce CTC at any time but which has been re-engineered to produce a maximum of 160 tonnes CTC annually. This can be incinerated if it is not consumed in permitted PA applications.

41. There are two newly identified PA uses into DEHPC polymerisation initiator (85.8 ODP tonnes) and 2,4-dichlorophenoxyacetic acid (2,4-D) (109.7 ODP tonnes), which were provisionally approved at the 17th MOP. The country has reported 32.7 ODP tonnes of CTC consumption in 2005, which is well below the CTC consumption limit for 2005 of 55.29 ODP

tonnes, but also less than the reported imports from EU-25 nations of around 40 tonnes in 2005 (UN Comtrade).

d) Argentina and Venezuela

42. Argentina and Venezuela are, like Mexico, countries with large use of CTC as feedstock for CFC production. Venezuela's Article 7 baseline is 1,107.15 ODP tonnes, reported consumption in 2005 is zero. Argentina has a 187.17 ODP tonnes baseline and reported imports of 20.39 ODP tonnes in 2005, resulting likewise in compliance with the 85% reduction target.

e) Others

43. Article 7 data suggest that in 2005 a few countries had exceeded the Montreal Protocol targets. These include the Democratic Republic of the Congo, Islamic Republic of Iran, Paraguay, United Arab Emirates, and Zimbabwe (see Annex I). Cross checking some of the information with the United Nations, Comtrade database, which reports on trade movements, suggests that Guatemala, Indonesia, the Libyan Arab Jamahiriya the Former Yugoslav Republic of Macedonia, Malawi, the Syrian Arab Republic, Turkey and Viet Nam may also not have met the 85% reduction targets.

IV. Policies and Supporting Activities

IV.1 Import Controls and Customs Training

44. For non-producing countries the primary regulatory policy has been the establishment of import controls. Producing countries have the same requirement but in addition have had to manage production phase-out, which will be discussed in the following section. In Brazil, Pakistan and the Democratic People's Republic of Korea it was noted that the process has been for the Ozone Unit to establish the volumes of CTC that could be legally imported, and to allocate quotas to specified traders or users based on historical imports. In China imports have been banned since April 2001. In India the only CTC imports allowed are for feedstock uses, and this is controlled by authorizing imports to licensed users only. The methodology is described in the World Bank Verification Framework. Customs officers are notified about the limits per importer (in the Democratic People's Republic of Korea this has been zero for some years), and are required to monitor the incoming shipments and notify the Ozone Unit on a timely basis.

45. Training of customs officers is an important part of the process, and so is the timing of the formal announcements of the reduced quotas, since for most Parties the first year of any control was the 85% reduction required in 2005. In Pakistan, late timing of quota announcements, and what appears to be weak inter-departmental communication, allowed excessive shipments into the country in the first half of 2005. This seems to have been corrected in the second half of 2005 and the country has now strengthened both its import controls and its departmental links. In India there was an inconsistency in 2004 between on-line data held by the Ministry of Commerce and the NOU data. Delayed establishment of quota systems and lack of communication between different departments such as Commerce and Environment might be factors also in several other countries, which according to Article 7 reporting did not meet the 85% reduction target for 2005 (see Annex I).

IV.2 Production Controls

46. Producers of CTC have been affected first and foremost by the reduction of demand for feedstock into the CFC sector, and secondly by the requirement to reduce production of CTC for controlled uses by 85% with the beginning of 2005. This inevitably has meant a gradual reduction of demand in many countries as conversions took place. The Democratic People's Republic of Korea closed down its CTC production in 2005 once the 15% production target had been met. China's policy has been to manage overall CTC supply versus demand by initially phasing out deliberate CTC production whilst reducing the quotas for co-produced CTC, and the funding has largely been directed towards the older deliberate producers. India allocated licenses to supply CTC for controlled uses only to the three CTC-producers on a pro-rata basis, but with no controls on the feedstock sector. Both sets of controls seem to be effective to date for managing supply to controlled uses, although Indian producers have achieved little reduction in their overall production levels.

47. Looking ahead, China requires all CTC producers to have an internal solution for managing the co-produced CTC either as feedstock for non-ODS products or to destroy it. India for now has taken the line that the ongoing feedstock demand in 2010 to DVAC will be sufficient to absorb co-produced CTC. This is a risk, partly because it will not be possible to exclude imported CTC from feeding this sector, and partly because DVAC itself is subject to demand fluctuations and uncertainties caused for example by the substitution of the product by other agrochemicals or by increased competition in export markets through the arrival of new DVAC producers, such as those emerging in China

IV.3 Consumption Controls

48. In China, the solvent sector consumption of CTC has been banned since 2003 and all remaining controlled uses of CTC are for PA applications. All users must have a consumption quota. For feedstock users this corresponds to the overall capacity to use CTC, whereas for controlled uses it is a negotiated figure generally declining over the years. In India, there is no specific consumption quota per user since the main CTC use is in the solvent sector, which is supplied by dealers and sub-dealers. The control is by the production allowance. In Pakistan, there are six designated importers with specific allowances, and this is the sole level of control. In Romania solvent use has been banned since 2005, and two PA users have licenses. In Brazil and Mexico all controlled users are registered.

IV.4 Awareness Activities

49. National programmes have included:

(a) Press announcements in local languages of restrictions on CTC availability and phase-out requirements;

(b) Communication with the national chemical industry associations and associated trade bodies, to foster awareness and create channels of communications;

(c) Provision of information about alternatives to CTC for solvent use. It might be noted that the entire palette of possible alternatives to CTC as solvent should be reviewed taking into account the most recent toxicological information. Some information dates back to 2001 and before, and concerns for instance

trichloroethylene, which is now regarded as a possible human carcinogen by some countries. In addition, in some cases, alternatives are cited by company trade names, which seems inappropriate.

IV.5 Technical Assistance (TA)

50. Many countries (Pakistan, India, China, Brazil, the Democratic People's Republic of Korea, and others) have benefited from workshops and seminars outlining the issues and providing an overview of the options available. China has used a portion of TA support to fund academic research into potential feedstock uses for CTC, which has greatly benefited the new CTC producers, and will use new funds to investigate the qualities of water-based versus solvent-based chlorinated polymers including CEVA, chlorinated rubber, and CPP. In India, the TA support programme is largely targeted at the solvent user sector, which is very diverse and which has needed significant help in both awareness rising and information distribution about alternatives solvents and cleaning processes.

V. Quality of Reporting, Documentation and Verification

51. In general the verifications appear to be well executed and the reports presented in time. In China, the existence of two parallel programmes (PA-I and PA-II) with separate reporting and verification makes it difficult to form a clear picture of achievements against overall targets. This is not in any way a statement about lack of transparency. China is very open about the results achieved, but it is difficult to consolidate the phase-out achieved versus overall targets, due to changing baselines as a result of incomplete and changing reporting of the feedstock component of CTC production and consumption. In Pakistan, the local verification consultant had advised that compliance had been achieved in 2005, and that all identified users of CTC had stopped using the product, when this was in fact not the case.

52. Some further observations are as follows:

(a) Much of the reporting is based on "cutting and pasting" older reports, and the issued documents are rarely identified on a page-by-page basis. It would be very useful to include headers or footers in the reports to show date and status (draft or final);

(b) In China, it was noted that financial audits conducted by the China National Audit Office complement the annual verification work conducted by the World Bank. This is to comply with national regulations and allows thorough checks of funds being spent under the Plan;

(c) CTC and CFC verification work may now be integrated since there is strong complementarity, not only in China but also in other countries where CFC and CTC production and consumption co-exist (in particular India);

(d) The most important future issue will be about the level of verification that will be achievable/affordable once the funding ceases in 2009/2010.

VI. Implementation Delays

53. Since CTC had no period of freeze prior to the 85% phase-out in 2005 and had a limited number of initially identified PA uses, many CTC users for other PA applications were only recently informed about the phase-out requirements. With this cautionary note, a number of delays in CTC conversion projects have been observed.

54. In the Democratic People's Republic of Korea, the implementation of the project to phase-out CTC as a fumigant was postponed until 2006. It could not start before the third tranche of the Plan at the amount of US$ 500,000 had been approved in July 2006. Most recently United Nations Security Resolution 1718 (2006) in November 2006 reconfirmed that supply to the Democratic People's Republic of Korea of plant equipment that could technically make chemical weapons is not allowed until the country ratifies the International Convention on Chemical Weapons. This would affect part of the proposed new equipment required for fumigation. Other equipment required for the production of chlorinated polymers is similarly blocked. There appears to be no solutions so far to this problem since turning to importation of CTC for use in the plants that have not yet destroyed the old equipment, or restarting of CTC production in undisclosed sites may result in non-compliance.

55. In Pakistan, the conversions of three of the CTC solvent-using enterprises were only made in early 2006. Another company had not received the new equipment at the time of the Mission (July 2006) but decided to move partially from CTC to trichloroethylene for cost reasons during 2006. If these enterprises continued using CTC at their baseline rate during 2005, they alone would have consumed more CTC than Pakistan's 2005 maximum allowable consumption. Therefore, late realisation of the projects seems to be at least partly the reason for Pakistan's non-compliance. The sole PA project has been subject to delays since 2002 but since the company has scrapped its CTC consuming line, and effectively has not produced since 2004, this has no bearing on CTC consumption.

56. In India, two companies suffered serious delays in obtaining the equipment necessary for full CTC phase-out, and delivery had not been made at the time of the mission in August 2006. However, they had phased out CTC consumption anyway in 2005 as planned by using the agreed alternative solvents and a combination of old and new equipment. This was at the cost, in each case, of reducing production volumes and a consequent loss of market share. There have been also some delays in disbursements to companies although the IAs have explanations.

VII. Sustainability and Risks for Future Compliance

57. CTC co- production will continue and is likely to increase. However, deliberate CTC production will stop and demand will be reduced. Any opportunities to sell CTC may bring higher returns than destroying it. Resulting low prices for CTC may provide a temptation for users who see CTC as the best available PA or solvent option. Hence ongoing monitoring systems will be vital.

58. A key critical issue for the sustainability of the phase-out is that, unlike other controlled substances that have been produced for specific uses, CTC is also generated as a by-product from chloromethanes plants (and the production can always be increased from its minimum level) and has the potential to be generated from perchlorination plants, even if these have been modified to have the capability to produce at a zero CTC output. Therefore, CTC availability can always be

presumed, so the sustainability of the phase-out depends on controlling and eliminating the demand for controlled uses and to further develop outlets for feedstock uses for non-ODS products.

59. In the PA consumption sector, choices have been between closure of operation generally backed by funding, or a change of technology – this varying from a total technology conversion to a simple change of solvent, or where approved the adoption of emission control measures. It is apparent that plant closures and technology changes carry no risk of re-conversion, but if the only change is that another solvent is used with the same equipment, a change back to using CTC again would be very easy. CTC was widely used because it is non-reactive and non-flammable, as well as very effective as a solvent especially for chlorination reactions with a high specific gravity requiring lower capacity reactors. The solvents selected to replace CTC have in general been more flammable requiring flame-proofing, are often more expensive, and at least as toxic as CTC. So cheaply available CTC, if associated with reduced monitoring, may well result in some companies returning back to CTC use.

60. In the Democratic People's Republic of Korea, project delays are caused recently by restrictions in the supply of equipment that could be used to produce chemical weapons. This includes part of the proposed new equipment required for replacing CTC use in fumigation. Other equipment required for the production of chlorinated polymers is similarly blocked. This could induce the country to import CTC above the maximum allowable level under the phase-out plan or even the Montreal Protocol. Alternatively, the country might restart CTC production in one of the numerous chemical complexes which would be difficult to verify.

61. It should be noted that within the PA sector, emission reduction measures do not bring about CTC elimination. In fact they are likely to foster continued use, and reduced monitoring after 2009 might bring about relaxation of controls and increase demand. Emission control efforts undertaken in China were so far not found to be successful.

62. In the solvent sector, much good work has been done with the higher volume CTC users that generally have seen the benefits of using closed modern equipment with alternative solvents and have effectively brought costs down. However, there is the risk that many smaller solvent consumers might switch back to CTC if available at a low cost. No part of the industrial market will ever call itself "metal-cleaning" although it is a convenient category within the Montreal Protocol context. Industries that bend, twist, shape, form or coat metal will at some stage use some solvent to remove impurities. This encompasses a vast range of industries, and many small enterprises do not require any investment beyond a simple bucket that can contain solvent. Given that there will be ongoing availability of CTC, the risk of reverting can never be discounted.

63. Since there is the potential for some parts of the PA and solvent sector to revert to CTC, control mechanisms become critical issues. Import management by non-producing countries is a clear requirement, and production quota control for the manufacturers is another vital component. Such activity undoubtedly needs continued funding, and it must be clarified how this will happen after 2009/2010.

64. Decision XVIII/17 of the Meeting of the Parties accepted the reasoning that some apparent over-production of CTC could be treated as stockpile for future feedstock use. It must be noted that chloromethanes plants cannot be readily turned on and off at a moments notice (and nor can the corresponding chlorine feedstock plant) and that a delayed or cancelled order might indeed bring about an apparent over-production if it happens at the end of the calendar year.

However, this decision does open the potential for any over-production by any Party for whatever reasons to be similarly described. It is not an issue only if the "over-production" is indeed consumed in the feedstock sector and if strict monitoring and verification ensures that there is no risk of leakage to controlled uses.

65. In 2004, IAs recommended that many Parties should build up stocks or "banks" of CTC as a safeguard against supply shortages in 2005, the year of 85% reduction versus the baseline. This appears to have happened in India, the Democratic People's Republic of Korea, Pakistan, and in China to some extent. It also seems to have been the case in Brazil. Thus compliance might have been not too difficult to reach in 2005. The real test is for 2006 when CTC stocks were running down and reduced availability was fully felt by the users but reporting will reveal this only in 2007.

66. India is a potential case of concern about future CTC management. By 2010 all CTC uses except for DVAC (and perhaps some small feedstock uses) will have been phased out. The minimum capacity to produce CTC has been stated as 11,508 tonnes, and is actually 19,348 tonnes. The audited demand for DVAC in 2005 was 15,511 metric tonnes, with new production capacity being added. The producers expect to see growth continue which is the optimistic scenario. However, like all agrochemicals, there are seasonal peaks and troughs, the potential for not-in-kind replacement, and the potential for loss of export markets to competitors. A systematic understanding of the growth prospects for DVAC and its export potential is vital for projecting future CTC use as feedstock in India.

VIII. Recommendations

67. The Executive Committee might wish to consider:

(a) Taking note of the findings presented in the final report on the evaluation of CTC phase-out projects and agreements (document UNEP//OzL.Pro/ExCom/51/12);

(b) Requesting the World Bank and SEPA to rationalize the reporting and verification system in China by integrating PA-1 and PA-2 programmes into one cohesive set of annual implementation report, verification report and work programme;

(c) Requesting China, in cooperation with the Ozone Secretariat, the Fund Secretariat and the World Bank to clarify the baselines for CTC production and consumption and to report back to the 52nd Meeting of the Executive Committee, including on possible adjustments required for the PA-I and II phase-out agreements.

(d) Requesting IAs to update the information on alternatives to CTC, especially in the solvent sector, avoiding the use of trade names and of potentially carcinogenic solvents;

(e) Requesting UNEP to organize discussions in regional network meetings about voluntary agreements between CTC exporting and importing countries to the effect that CTC exporting enterprises request certificates from their importing clients that they either have verified feedstock use, or a valid import license within the importing country's quota system, prior to shipment;

(f) Recommending to CTC producers in India to use a precautionary approach to CTC management by installing destruction facilities, if not yet available, in case the feedstock outlets – essentially for DVAC – should not grow as expected or would be squeezed by increasing CTC imports.

(g) Taking into account, in future deliberations about funding of institutional strengthening projects, the need to maintain monitoring and verification of all CTC production and consumption beyond 2010.

(h) Requesting the Fund Secretariat to forward, via the Ozone Secretariat, the final report on the evaluation of CTC phase-out project and agreements (document UNEP/OzL.Pro/ExCom/51/12) to the TEAP so that it can take it into account in its further deliberations on process agents.

ANNEX I

CTC CONSUMPTION PHASE-OUT AND COMPLIANCE STATUS FOR ALL ARTICLE 5 COUNTRIES

Country	Baseline	85% Reduction	2005 Data	Amount Over 85% Reduction	Compliance Decision	2006 Action Plan	2007 Action Plan	2008 Action Plan	2009 Action Plan Target
Afghanistan	0.9	0.1	0.1						
Albania	3.1	0.5	0.0						
Algeria	20.9	3.1	2.2						
Angola	NDR	NDR	0.0						
Antigua and Barbuda	0.0	0.0	0.0						
Argentina	187.2	28.1	20.4						
Armenia	0.0	0.0	0.0						
Bahamas	0.0	0.0	0.0						
Bahrain	0.7	0.1	0.0						
Bangladesh	5.7	0.9	0.8						
Barbados	0.0	0.0	0.0						
Belize	0.0	0.0	0.0						
Benin	0.0	0.0	0.0						
Bhutan	0.0	0.0	0.0						
Bolivia	0.3	0.0	0.1	0.1					
Bosnia and Herzegovina	0.0	0.0	0.0						
Botswana	0.0	0.0	0.0						
Brazil	411.6	61.7	0.0						
Brunei Darussalam	0.0	0.0	0.0						
Burkina Faso	0.0	0.0	0.0						
Burundi	0.0	0.0	0.0						
Cambodia	0.0	0.0	0.0						
Cameroon	0.0	0.0	0.0						
Cape Verde	0.0	0.0	0.0						
Central African Republic	0.0	0.0	0.0						
Chad	0.0	0.0	0.0						
Chile	0.6	0.1	-0.1						
The People's Republic of China*	38,220.6	5,733.1	1,060.3						
Colombia	6.1	0.9	0.3						
Comoros	0.0	0.0	0.0						
The Republic of Congo	0.6	0.1	0.0						
The Democratic Republic of the Congo	15.3	2.3	16.5	14.2	Decision XVIII/21	16.50	2.20	0.00	
Cook Islands	0.0	0.0	0.0						
Costa Rica	0.0	0.0	0.0						
Croatia	3.9	0.6	0.3						
Cuba	2.7	0.4	0.0						
Djibouti	0.0	0.0	0.0						
Dominica	0.0	0.0	0.0						
Dominican Republic	29.0	4.4	0.0						
Ecuador	0.5	0.1	0.0						
Egypt	38.5	5.8	5.5						
El Salvador	0.0	0.0	0.0						
Eritrea	0.0	0.0	0.0						
Ethiopia	0.0	0.0	0.0						
Fiji	0.0	0.0	0.0						
Gabon	0.0	0.0	0.0						
Gambia	0.0	0.0	0.0						
Georgia	0.0	0.0	0.0						
Ghana	0.4	0.1	0.0						
Grenada	0.0	0.0	0.0						
Guatemala	10.6	1.6	0.0						
Guinea	0.0	0.0	0.0						
Guinea Bissau	0.0	0.0	0.0						
Guyana	0.0	0.0	0.0						
Haiti	0.0	0.0	0.0						
Honduras	0.0	0.0	0.0						
India	11,505.4	1,725.8	1,644.0						
Indonesia	0.0	0.0	0.0						
Iran	77.0	11.6	13.6	2.1					
Jamaica	2.8	0.4	0.0						
Jordan	40.3	6.0	2.2						
Kenya	65.9	9.9	0.2						
Kiribati	0.0	0.0	0.0						
The Democratic People's Republic of Korea	1,285.2	192.8	191.4						
Korea, Republic of	638.0	95.7	-437.8						
Kuwait	0.0	0.0	0.0						
Kyrgyzstan	0.0	0.0	0.0						
Lao, PDR	0.0	0.0	0.0						
Lebanon	0.0	0.0	0.0						
Lesotho	0.0	0.0	0.0						
Liberia	0.2	0.0	0.0						
The Lybian Arab Jamahiriya	0.0	0.0	0.0						
The Former Yugoslav Republic of Macedonia	0.1	0.0	0.0						

CTC CONSUMPTION PHASE-OUT AND COMPLIANCE STATUS FOR ALL ARTICLE 5 COUNTRIES

Country	Baseline	85% Reduction	2005 Data	Amount Over 85% Reduction	Compliance Decision	2006 Action Plan	2007 Action Plan	2008 Action Plan	2009 Action Plan Target
Madagascar	0.0	0.0	0.0						
Malawi	0.0	0.0	0.0						
Malaysia	4.5	0.7	0.0						
Maldives	0.0	0.0	0.0						
Mali	0.0	0.0	0.0						
Marshall Islands	0.0	0.0	0.0						
Mauritania	0.0	0.0	0.0						
Mauritius	0.0	0.0	0.0						
Mexico **	187.5	28.1	89.5	61.4	Decision XVIII/30			9.38	0.00
Micronesia	0.0	0.0	0.0						
Moldova	0.0	0.0	0.0						
Mongolia	0.0	0.0	0.0						
Morocco	1.1	0.2	0.0						
Mozambique	0.0	0.0	0.0						
Myanmar	0.0	0.0	0.0						
Namibia	0.0	0.0	0.0						
Nauru	0.0	0.0	0.0						
Nepal	0.9	0.1	0.1						
Nicaragua	0.0	0.0	0.0						
Niger	0.0	0.0	0.0						
Nigeria	152.8	22.9	0.0						
Niue	0.0	0.0	0.0						
Oman	0.1	0.0	0.0						
Pakistan	412.9	61.9	148.5	86.6	Decision XVIII/31	41.80			
Palau	0.0	0.0	0.0						
Panama	0.0	0.0	0.0						
Papua New Guinea	0.0	0.0	0.0						
Paraguay	0.6	0.1	6.8	6.7					
Peru	1.0	0.2	0.0						
Philippines	0.0	0.0	0.0						
Qatar	0.0	0.0	0.0						
Romania	368.6	55.3	32.7						
Rwanda	0.0	0.0	0.0						
Saint Kitts and Nevis	0.0	0.0	0.0						
Saint Lucia	0.0	0.0	0.0						
Saint Vincent and the Grenadines	0.0	0.0	0.0						
Samoa	0.0	0.0	0.0						
Sao Tome and Principe	0.0	0.0	0.0						
Senegal	0.0	0.0	0.0						
Serbia	NDR	NDR	1.7						
Seychelles	0.0	0.0	0.0						
Sierra Leone	2.6	0.4	0.0						
Singapore	0.0	0.0	0.0						
Solomon Islands	0.0	0.0	0.0						
South Africa	0.0	0.0	0.0						
Sri Lanka	35.1	5.3	3.6						
Sudan	2.2	0.3	0.3						
Suriname	0.0	0.0	0.0						
Swaziland	0.0	0.0	0.0						
Syrian Arab Republic	0.0	0.0	0.0						
Tanzania	0.1	0.0	0.0						
Thailand	7.5	1.1	0.0						
Togo	0.0	0.0	0.0						
Tonga	0.0	0.0	0.0						
Trinidad and Tobago	0.0	0.0	0.0						
Tunisia	2.9	0.4	0.3						
Turkey	105.1	15.8	2.2						
Turkmenistan	0.0	0.0	0.0						
Tuvalu	0.0	0.0	0.0						
Uganda	0.4	0.1	0.0						
United Arab Emirates	0.0	0.0	0.4	0.4					
Uruguay	0.4	0.1	0.0						
Vanuatu	0.0	0.0	0.0						
Venezuela	1,107.2	166.1	0.0						
Viet Nam	1.6	0.2	0.1						
Yemen	0.0	0.0	0.0						
Zambia	0.7	0.1	0.0						
Zimbabwe	11.6	1.7	3.5	1.8					
TOTAL	54,981.5	8,247.2	2,809.7	173.1					

*China's CTC Consumption baseline was reported in 2006 as 55,881.4 ODP tonnes; this was also used as baseline in the PA-II Agreement and needs clarification.

** Mexico's baseline according to MOP Decision XVIII/29. The target for 2009 is zero according to Decision XVIII/30.

Source: Article 7 data and Decisions by the Meeting of the Parties (MOP)

ANNEX II

CTC PRODUCTION PHASE-OUT AND COMPLIANCE STATUS FOR ALL ARTICLE 5 COUNTRIES

Country	Baseline	85% Reduction Target	2005 Data	Amount over 85% Reduction
Argentina	0.0	0.0	0.0	
Brazil	11,629.6	1,744.4	0.0	
The People's Republic of China*	11,696.7	1,754.5	1,060.3	
India	11,552.9	1,732.9	1,660.5	
The Republic of Korea	584.8	87.7	-224.4	
The Democratic People's Republic of Korea	1,285.2	192.8	191.4	
Mexico	0.0	0.0	0.0	
Romania	371.5	55.7	30.9	
South Africa	0.0	0.0	0.0	

* China's baseline was reported in 2006 as 29,367.4 ODP tonnes; this was also used for the accelerated phase-out for CFC/CTC/H and for the PA-II Agreement. The difference needs clarification.

Source: Article 7 data