MONTREAL PROTOCOL

ON SUBSTANCES THAT DEPLETE

THE OZONE LAYER

UNEP

REPORT OF THE
TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

OCTOBER 2014

ESSENTIAL USE NOMINATIONS REPORT

FINAL EVALUATION

UNEP
OCTOBER 2014 REPORT OF THE TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

ESSENTIAL USE NOMINATIONS REPORT

FINAL EVALUATION

Montreal Protocol
on Substances that Deplete the Ozone Layer

Report of the
UNEP Technology and Economic Assessment Panel

October 2014

ESSENTIAL USE NOMINATIONS – FINAL EVALUATION REPORT

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

Co-ordination:	**Technology and Economic Assessment Panel**
Composition of the report:	Lambert Kuijpers, Bella Maranion, Keiichi Onishi
Layout and formatting:	Ozone Secretariat (UNEP) Marta Pizano (UNEP TEAP)
Date:	October 2014

Under certain conditions, printed copies of this report are available from:

UNITED NATIONS ENVIRONMENT PROGRAMME
Ozone Secretariat, P.O. Box 30552, Nairobi, Kenya

This document is also available in portable document format from the UNEP Ozone Secretariat's website:

http://ozone.unep.org/en/assessment_panels.php

Disclaimer

The United Nations Environment Programme (UNEP), the Technology and Economic Assessment Panel (TEAP) Co-chairs and members, the Technical Options Committees Co-chairs and members, the TEAP Task Forces Co-chairs and members, and the companies and organisations that employ them do not endorse the performance, worker safety, or environmental acceptability of any of the technical options discussed. Every industrial operation requires consideration of worker safety and proper disposal of contaminants and waste products. Moreover, as work continues - including additional toxicity evaluation - more information on health, environmental and safety effects of alternatives and replacements will become available for use in selecting among the options discussed in this document.

UNEP, the TEAP Co-chairs and members, the Technical Options Committees Co-chairs and members, and the TEAP Task Forces Co-chairs and members, in furnishing or distributing this information, do not make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or utility; nor do they assume any liability of any kind whatsoever resulting from the use or reliance upon any information, material, or procedure contained herein, including but not limited to any claims regarding health, safety, environmental effect or fate, efficacy, or performance, made by the source of information.

Mention of any company, association, or product in this document is for information purposes only and does not constitute a recommendation of any such company, association, or product, either express or implied by UNEP, the Technology and Economic Assessment Panel Co-chairs or members, the Technical and Economic Options Committee Co-chairs or members, the TEAP Task Forces Co-chairs or members or the companies or organisations that employ them.

Acknowledgements

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

Foreword

This report contains the final assessment of the 2014 essential use nominations by the CTOC

The UNEP Technology and Economic Assessment Panel (TEAP):

Lambert Kuijpers, co-chair	NL	Jose Pons-Pons	VEN
Bella Maranion, co-chair	USA	Ian Porter	AUS
Marta Pizano, co-chair	COL	Miguel Quintero	COL
Paul Ashford	UK	Helen Tope	AUS
Mohamed Besri	MOR	Dan Verdonik	USA
David Catchpole	UK	Ashley Woodcock	UK
Marco Gonzalez	CR	Masaaki Yamabe	J
Sergey Kopylov	RF	Shiqiu Zhang	PRC
Kei-ichi Ohnishi	J	Jianjung Zhang	PRC
Roberto Peixoto	BRA		

TABLE OF CONTENTS

FOREWORD ..... **VI**

1 INTRODUCTION **1**

2 REASSESSMENT OF EUN FOR LABORATORY AND ANALYTICAL USES OF CTC IN CHINA **3**

2.1 SIGNIFICANT DELAYS IN REVISING STANDARDS 3

2.1.1 Standards to revise related to CTC in laboratory and analytical uses *3*
2.1.2. Process and procedure of the standard revision *3*
2.1.3 Why China cannot copy the approaches used in other countries *4*

2.2 AGREEMENTS UNDER THE MONTREAL PROTOCOL TO PHASE-OUT CTC WITH SUPPORT FROM THE MULTILATERAL FUND 4

2.3 INADEQUATE TECHNICAL JUSTIFICATION FOR THE 90 TONNES OF CTC TO CONDUCT WATER ANALYSIS 5

2.4 CTOC COMMENTS ON ADDITIONAL INFORMATION FOR THE NOMINATION FOR CTC LABORATORY AND ANALYTICAL USES ("TESTING OF OIL, GREASE AND TOTAL PETROLEUM HYDROCARBONS IN WATER") FROM CHINA 6

3 CONCLUSION **7**

1. Introduction

China submitted a nomination for an Essential Use Exemption of carbon tetrachloride (CTC) for Laboratory and Analytical uses ("testing of oil, grease and total petroleum hydrocarbons in water") for 90 tonnes CTC in 2015 and 90 tonnes CTC in 2016. However, the CTOC was unable to recommend the Essential Use Nomination of 90 MT CTC in 2015 in the TEAP EUN Report May 2014, Vol.2. In addition, the CTOC was unable to recommend the nomination for 2016 given that it was unable to recommend the amount requested for 2015 without additional information, affecting future nominations. CTOC was of the view that at this advanced stage of CTC phase-out, replacement technologies were well known and the only issues remaining were the implementation of these technologies and the management of stockpiles. Under these circumstances, CTOC believed that any essential use nomination should be presented one year in advance and for one year only. Specifically, the CTOC did not recommend the nomination for 2015 due to its assessment of the available information against the essential use criteria and the concerns shown below:

1. Significant delays in drafting, submitting and implementing the revised standards, as described in the nomination, even though ODS-free alternative methods have been available for 15 years;
2. Agreements under Montreal Protocol to phase out CTC in China using the Multilateral Fund;
3. Inadequate technical justification for the quantity of 90 tonnes of CTC requested to conduct water analysis.

After bilateral consultations at 34th OEWG, China agreed to submit additional information for the nomination for CTC Laboratory and Analytical uses ("testing of oil, grease and total petroleum hydrocarbons in water"). Additional information was received by CTOC on September 5th 2014.

2. Reassessment of EUN for laboratory and analytical uses of CTC in China

Following is further elaboration on the four points presented in the introductory section, which formed the basis of the EUN reassessment conducted by CTOC.

2.1 Significant delays in revising standards

Regarding the first concern, China explained the reason for the delay as follows:

> *"In November of 2002 and November of 2005, the Executive Committee of the Multilateral Fund approved respectively China's CTC production and Process Agent Phase-out Plan phase I and phase II. By 2010 China had reached the phase-out targets set by the two agreements and successfully accomplished the plans. For many years, the Meeting of the Parties set out the exemption list for laboratory and analytical uses based on TEAP's evaluation work. Through the Decision VII/11, XI/15, XVIII/15 and XIX/18, nine types of CTC use have been excluded from the list. China has no issues with eight out of the nine types, but has met difficulties in replacing CTC in testing oil in water. China did not wait, but immediately undertook surveys and research in 2008 and 2009, even before the CTC and PA II Phase-out Plan had finished. Based on these studies, China prepared for the standards revision, making plans to find substitutes, designing a management system and other endeavors".*

2.1.1 Standards to revise related to CTC in laboratory and analytical uses

The standards revision of CTC in laboratory and analytical uses involve 14 industries. Among these industries, the universal standards include 55 national standards and 21 industrial (ministerial/municipal) standards. In addition, there are over 200 national standards that regulate extended products which use CTC.

Among all laboratory and analytical uses, the amount of CTC used in testing oil in water account for the largest percentage. After evaluation, China adopt the strategy of revising the national standard of testing oil in water as the first step, to replace the existing approach by using ODS-free reagents or methods. After the national standard is revised, related standards will change accordingly.

2.1.2. Process and procedure of the standard revision

In China, the national standards revision observes strict process and procedure. The Science and Standards Department of the Ministry of Environmental Protection (MEP) hosts the revision of China's national standard *HJ 637-2012 Water quality - Determination of petroleum oil, animal and vegetable oils- Infrared photometric method*. It usually takes two to three years on average to finish a revision. In 2011, the MEP started the bidding for revising *HJ 637-2012*. Guangdong Environmental Monitoring Center (GEMC) won the bidding. In the following year, GEMC carried out comprehensive comparative experiments of the existing reagents and approaches available domestically and internationally. Based on the experimental results, the GEMC proposed a new approach to the review panel in February 2014. The proposal is to use Mid-infrared Laser Spectroscopy to replace the current Infrared Photometric method. The new approach will use cyclohexane as the exacting agent.

According to the schedule, GEMC has been testing the validation of the approach in the second half of 2014. As the validation results reach the requirements, they will submit the draft report by the end of 2014. MEP will hold another evaluation and a review meeting.

When MEP approves the submitted report, it will be released in 2015. After the new standard is approved, it still needs one or two years to promulgate and promote to the laboratory users.

2.1.3 Why China cannot copy the approaches used in other countries

The standard revision mainly follows four principles: first, it should comply with the Montreal Protocol, e.g. to use ODS-free reagent or approach; second, the detection limits and testing range should meet the requirements of relevant environmental standards and environmental protection tasks; third, the approach should be accurate and reliable, and meet the requirements of all the special indicators; fourth, the method should have universal applicability and be easily used widely.

Revised standards must comply with the actual situation of the host country. China must ensure the basic needs of the national water quality monitoring and water security. Article 2 countries and some organizations have stopped using CTC testing oil-in-water and replaced it with non-ODS reagent or method many years ago. The GEMC has done comparative experiments on the existing approaches. The experiments find that the methods used by Article 2 countries have different requirements and conditions in the concentration of impurities in the water, the detection limit, and the purity of extraction solvent. China cannot simply copy them.

For example, tetrachlorethylene has the advantages of being non-flammable, non-explosive, of low toxicity, low volatility, a high boiling point (121.1 ° C), and it is cheap. But it has two disadvantages: First, tetrachlorethylene is unstable in sunlight, which will generate free acid in air, water or heat. Second, it is difficult to reach the required purity and hard to put in application.

According to the *requirements* of *HJ 637-2012*, the extraction reagent should not have sharp peaks in scanning between 2800cm-1 ~ 3100 cm-1, and the absorbance value should not exceed 0.12. The GEMC research group tested tetrachlorethylene with different purity produced by different manufacturers, and its absorbance was between 36.1 ~ 76.5. Tetrachlorethylene is unstable and its production process requires the addition of alcohols, phenols and other substances as a stabilizer. These materials may interfere with the determination. To obtain tetrachlorethylene of the necessary purity, the research group used different methods for purification. They also commissioned a reagent plant to carry out the work, but the absorbance is still 5.32 - 69.9, which is insufficiently pure.

After a series of futile attempts to replace the reagent, the research team chose to change the test method route. After comparing infrared photometry, spectrophotometry, molecular fluorescence spectrometry, gas chromatography, and mid-infrared laser spectroscopy, they ultimately decided to use mid-infrared laser spectroscopy, using cyclohexane as the extraction reagent, a relatively new approach.

2.2 Agreements under the Montreal Protocol to phase-out CTC with support from the Multilateral Fund

China explained the relationship of the essential-use exemption application to the CTC phase-out plans as follows:

> "*The 38th meeting of the Executive Committee of the Multilateral Fund (held in November 2002), and the 47th meeting of the Executive Committee of the Multilateral Fund (November 2005), approved and signed agreements for phase I and phase II of the "China CTC production and process agent consumption phase out plan". The two agreements set phase-out goals for the production of CTC and consumption of CTC as a process agent. The aim was to achieve by January 2010 the complete elimination of*

CTC production and CTC as a process agent, with the exception of essential-use exemptions.

China has completed its phase-out plans and has realized its goals. The phase-out plans allow for "possible essential-use exemptions". China's application for exemption for the use of CTC in "oil in water" tests is based on Decision XXIII/6. There is no disagreement with China's CTC phase-out plans for CTC production and process agent consumption. Decision XXIII/6 is as follows:

1. *" To allow parties operating under paragraph 1 of Article 5 until 31 December 2014 to deviate from the existing ban on the use of carbon tetrachloride for the testing of oil, grease and total petroleum hydrocarbons in water in individual cases where such parties consider doing so to be justified;*
2. *To clarify that any deviation beyond that described in the preceding paragraph should take place only in accordance with an essential-use exemption, in particular in respect of:*

    a. *The use of carbon tetrachloride for the testing of oil, grease and total petroleum hydrocarbons in water beyond 2014;*
    b. *Any other use already excluded from the global laboratory exemption beyond 2012;…*"

2.3 Inadequate technical justification for the 90 tonnes of CTC to conduct water analysis

One consideration for CTOC was "the justification for the 90 tonnes of CTC to conduct water analysis." Although China submitted additional information on the measuring sites, frequencies etc, there remains a large discrepancy between the volume calculated for estimated actual requirements and the nominated quantity of 90 tonnes.

China adopted a top-down calculation method to estimate the amount of CTC used for the "oil in water" testing purposes. In 2009, China commissioned the Chinese Chemical Reagent Information Center to conduct an investigation into CTC usage for laboratory and analytical purposes. According to the survey results, the amount of CTC used for testing "oil in water" as a part of the water quality monitoring accounted for about 34% of the total CTC laboratory usage. In subsequent years in Article 7 data, they used the value of 34% of total CTC as an estimate of the amount of CTC used in "oil in water" tests.

Before the 34th OEWG, and following CTOC's requirements and questions in the EUN Report, China submitted both the unit amount of CTC used for oil-in-water testing, as well as the total number of laboratories and agencies. However the situation is complicated by the fact that there are a large number of water quality monitoring agencies and laboratory users widely distributed across China. This makes it impossible to monitor every user, and therefore accurate estimates of CTC usage cannot be obtained by the method of summing the contribution of individual agencies. Therefore, rather than concentrate monitoring on the end users, China's focus instead has been on the producers and dealers. China issues consumption quotas annually based on historical data of reagent sales, thus capping the total amount of CTC available; simultaneously they increase awareness and training so as to improve laboratory reagent waste treatment and recovery.

CTOC pointed out that the CTC amount for testing "oil in water" as shown in China's Article 7 data, decreased from 90 tonnes to 70 tonnes over the years 2010-2012, yet China is applying for an exemption amount of 90 tonnes for 2015:

"China is applying for the 90 tons of exemption for the following reasons. It is true that in recent years, through the strengthening of advocacy, training and laboratory reagents' management and other measures, China's "oil in water" showed a decreasing trend in the overall amount. However the Chinese government attaches great importance to environmental protection and last year introduced strict measures to enhance the monitoring of air and water quality. China's "Water Pollution Prevention Action Plan" is under development and will be introduced soon. The full implementation of the program by 2015 will further enforce water quality monitoring, which in turn will increase the amount of CTC used. Therefore, to meet the requirements necessitated by enhanced domestic water quality monitoring, China applied for an exemption of 90 tonnes of CTC. At the same time, China is stepping up revisions to the existing standards and working towards the smooth introduction of the new standards.

Furthermore, China retains some flexibility on the amount to be exempted. They are willing to consider the adoption of the past three years' average usage, as shown in Table 1. China will reconsider the amount of the application are shown in Table 2:

Table 1. Year Prior to Nomination (metric tonnes)

Year	**2010**	**2011**	**2012**
Quantity	90	80	70

Table 2. China's nomination of CTC for L&A use for testing of oil (metric tonnes)

Year	**2015**	**2016**
Nomination	80	70

2.4 CTOC comments on additional information for the nomination for CTC laboratory and analytical uses ("testing of oil, grease and total petroleum hydrocarbons in water") from China

CTOC acknowledges China's efforts to replace the use of CTC for this application, and that it was difficult to replicate the existing alternative technology due to the impurity of solvents available in China. The CTOC also acknowledges that the agreements made by Multilateral Fund do not include the phase-out of CTC in Laboratory and Analytical uses, and that China has been consistent with Decision XXIII/6 in its essential use nomination of CTC for this application. Furthermore, the CTOC acknowledges the top-down calculation method that China adopted to estimate the total volume of CTC usage. CTOC also commends China's subsequent reduction in the nominated quantities by 10 tonnes for 2015 and by 20 tonnes for 2016 (compared with the previously nominated 90 tonnes for both years) by acceleration of the transition to the new technology.

3 Conclusion

After careful review of the additional information provided by China, CTOC recommends the Essential Use Nomination of 80 tonnes CTC for 2015 for "testing of oil, grease and total petroleum hydrocarbons in water" for China. In addition, the CTOC is unable to recommend the nomination for 2016 at this stage. As previously mentioned, CTOC believes any essential use nomination should be presented one year in advance and for one year only.

Given the timing presented for the approval and introduction of the new testing standards in China, an update of the status of the approval process could be submitted with any request in 2015 for an essential use exemption for 2016, with an indication as to when the final request for CTC for this application will be made.