

FINAL VALIDATION REPORT

“REDUCTION OF GHG EMISSIONS IN PROPYLENE OXIDE PRODUCTION AT MTP HPPO MANUFACTURING CO., LTD”.

**RINA**

Document Prepared By RINA SERVICES S.P.A

Project Title	Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd
Version	1.1Aa
Report ID	2013-IQ-29-MD

Report Title	Final validation report “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd”.		
Client	South Pole Carbon Thailand Co., Ltd.		
Pages	101		
Date of Issue	13-November-2014		
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Summary:

RINA Services S.p.A. (RINA), commissioned by South Pole Carbon Thailand Co., Ltd., has performed the validation of the project activity “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, with regard to the relevant requirements for CDM and VCS activities.

The objective of the validation is to have an independent evaluation of a project activity by a designated operational entity against the requirements of the VCS Version 3 and GHG program applied, on the basis of the project design document. The validation scope is to review the VCS PD against the UNFCCC criteria for CDM and VCS Version 3 requirements.

Validation was conducted using RINA procedures in line with the requirements specified in the CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques. The validation consisted of desk review, on-site assessment and the resolution of outstanding issues and the issuance of the final validation report.

The validation shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS Version 3 requirements, which refer to CDM rules, in order to be certified.

04 Corrective Action Requests (CARs) and 17 Clarification Requests (CLs) were identified for the proposed VCS project activity based on VCS-PD version 00 of 06-January-2014 in relation to all relevant VCS requirements and UNFCCC requirements for the CDM and the applied baseline and monitoring methodology and these CARs and CLs are successfully closed after necessary corrections/clarifications by the client.

In conclusion, it is RINA’s opinion that the project activity “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd”, in “Thailand”, as described in the VCS-PD version 02 of 22-September-2014, meets all relevant requirements for VCS activities and all relevant host Party criteria and correctly applies the Approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013. Hence RINA requests the registration of the project as a VCS project activity”.

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Abbreviations

BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CH ₄	Methane
CHP	Cumene Hydroperoxide
CHPO	Chlorohydrin Process
CL	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CRT	Coordination and Technical Control Staff
DCI	Certification Division of RINA Services Spa
EB	Executive Board
EIA	Environmental Impact assessment
EPD	Environmental Product Declaration
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
HP	Hydrogen Peroxide
HPPO	Hydrogen Peroxide – based PO technology
IPCC	Intergovernmental Panel on Climate Change
ME	Methodology Element
MoV	Means of Verification
MP	Monitoring Plan
MR	Monitoring Report
MHMCL	MTP-HPPO Manufacturing Co. Ltd.
NGO	Non-governmental Organization
ODA	Official Development Assistance
PD	Project Document
PE	Project Emission
PO	Propylene Oxide
POSM	Propylene Oxide – Styrene Monomer
POTBA	Propylene Oxide – Tertiary Butanol
PU and I	Process Utilities and Instrumentation
Ref.	Document Reference
RINA	RINA Services Spa
SPCTCL	South Pole Carbon (Thailand) Co., Ltd
SS(s)	Sectoral Scope(s)
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America

VCS	Verified Carbon Standard
VCU	Verified Carbon Units
VVB	Validation and Verification Body

1 INTRODUCTION

South Pole Carbon Thailand Co., Ltd., has commissioned RINA to carry out the validation of the “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” project in Thailand.

This report summarizes the findings of the validation of the project, performed on the basis of VCS Requirements and UNFCCC criteria for CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting.

1.1 Objective

The objective of the validation is to have an independent evaluation of a project activity by a designated operational entity against the requirements of the VCS Version 3 and GHG program applied, on the basis of the project design document. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant VCS Version 3 requirements and GHG program requirements are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of Voluntary Carbon Units (VCUs).

1.2 Scope and Criteria

The validation scope is to review the VCS PD against the UNFCCC criteria for CDM and VCS Version 3 Requirements.

UNFCCC criteria for CDM refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, the procedures for registration of programme of activity as a single CDM and the subsequent decisions by the CDM Executive Board.

Validation is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

1.3 Level of Assurance

All the revisions of the validation report before being submitted to the client were subjected to an independent internal technical review to confirm that all validation activities had been completed according to the pertinent RINA instructions.

The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme VCS VER validation and verification. The validation team and the technical reviewers consist of the following personnel:

Role/Qualification	Last Name	First Name	Country
VCS Team Leader, VCS Validator and Technical Expert	Arokiasamy	Cyril Augustus	India
VCS Validator	Krishnan	Praveen Kumar	India
Technical Reviewer	Valoroso	Rita	Italy
Technical Reviewer Technical Expert	Ramani	Venkatarama	India

1.4 Summary Description of the Project

As detailed in the VCS PD /01/ and observed during the onsite visit, the project involves installation of Hydrogen Peroxide-based Propylene Oxide (HPPO) technology for the manufacture of Propylene Oxide (PO) at the production facility of MTP HPPO Manufacturing Co., Ltd, a joint venture between The Siam Cement Public Co., Ltd and The Dow Chemical Company. The project activity uses Hydrogen Peroxide-based Propylene Oxide (HPPO) technology instead of the conventional Chlorohydrin process. The conventional Chlorohydrin process is one of the typical processes in the Propylene Oxide industry that involves hydrochlorination process. In the Chlorohydrin process, Propylene (C_3H_6) is combined to hypochlorous acid to form a Chlorohydrin intermediate which is subsequently dechlorohydrinated to PO and leads to the formation of salts. While in the HPPO process, Propylene and Hydrogen peroxide is combined to produce PO.

The project activity reduces GHG emissions by usage of lesser GHG intensive reagents and reduced process energy requirements in the HPPO technology. The project activity is expected to prevent 239,356 tCO₂ emissions in a year and a total of 2,393,569 tCO₂ for a period of 10 years.

The plant is located within the Asia Industrial Estates (AIE) site near Map Ta Phut, Rayong, Thailand.

2 VALIDATION PROCESS

2.1 Method and Criteria

Validation was conducted using RINA procedures in line with the VCS Version 3 requirements and the requirements specified in the CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques.

The validation consisted of the following three phases:

- Document review;
- On-site assessment;
- The resolution of outstanding issues and the issuance of the final verification report and certification.

2.2 Document Review

The VCS PD version 02 of 22-September-2014 and its previous version 01 of 11-September-2014 and version 00 of 06-January-2014 /1/, in particular the applicability of the methodology /10/, the baseline determination, the additionality of the project activity, the starting date of the project, the monitoring plan, the emission reduction calculations provided in the form of a spreadsheet, “ER calculation-22092014.xlsx” version 1.3 dated 22-September-2014 and its previous versions “ER calculation-09092014.xlsx” version 1.2 dated 09-September-2014 and ER calculation-30092013.xlsx version 1 of 30-September-2013 /02/ were assessed as part of the validation.

The following table lists the documentation that was reviewed during the validation:

/1/	Southpole Carbon Asset Management Limited: VCS PD for “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, version 02 of 22-September-2014. VCS PD for “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, version 01 of 11-September-2014. VCS PD for “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, version 00 of 06/01/2014.
/2/	Southpole Carbon Asset Management Limited: Emission Reduction Calculation Spreadsheet “ER calculation-22092014.xlsx” version 1.3 dated 22-September-2014. Emission Reduction Calculation Spreadsheet “ER calculation-09092014.xlsx” version 1.2 dated 09-September-2014. Emission Reduction Calculation Spreadsheet “ER calculation-30092013.xlsx” version 1 of 30-September-2013, submitted by email dated 15-January-2014.
/3/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.5 of 08-October-2013
/4/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.4 of 08-October-2013
/5/	VCS Verified Carbon Standard: VCS Validation Report Template VCS Version 03, v3.3 of 08-October-2013
/6/	VCS Verified Carbon Standard: VCS Project Description Template VCS Version 03, v3.1 of 04-October-2012 VCS Verified Carbon Standard: VCS Project Description Template VCS Version 03, v3.2 of 08-October-2013
/7/	VCS Verified Carbon Standard: VCS Validation and Verification Manual VCS Version 03, v3.1 of 08-October-2013
/8/	CDM Executive Board: Clean Development Mechanism Project Standard, Version 07.0 of 01-June-2014. CDM Executive Board: Clean Development Mechanism Project Standard, version 06.0 of 11/04/2014
/9/	CDM Executive Board: Clean Development Mechanism Validation and Verification Standard, version 07.0 of 01/10/2013 CDM Executive Board: Clean Development Mechanism validation and verification standard, version 06.0 of 11/04/2014
/10/	VCSA: Approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013
/11/	CDM Executive Board, Glossary of CDM terms, version 07.0 of 23-November-2012

/12/	VCS Verified Carbon Standard: Program Definitions VCS Version 03, v3.5 of 08-October-2013
/13/	Dow Chemicals website: http://www.dow.com/thailand/about/locations.htm Argument: Location of the project activity Language: English Retrieved on: 16-January-2014.
/14/	CDM Executive Board: Tool for the demonstration and assessment of additionality, version 07.0.0 of 23-November-2012
/15/	CDM Executive Board: Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 01 of 16-May-2008
/16/	CDM Executive Board: Tool to calculate the emission factor for an electricity system, version 04.0 of 04-October-2013
/17/	CDM Executive Board: Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion, version 02 of 02-August-2008.
/18/	CDM Executive Board: Guidelines for objective demonstration and assessment of barriers, version 01 of 16-October-2009.
/19/	CDM Executive Board: Guidelines on common practice, version 02.0 of 13-September-2012.
/20/	Website: http://www.miga.org/documents/ChlorAlkali.pdf Argument: Environmental Guidelines for Chlor-Alkali Industry Language: English Retrieved on: 20-January-2014
/21/	Wikipedia: http://en.wikipedia.org/wiki/Multilateral_Investment_Guarantee_Agency Argument: About Multilateral Investment Guarantee Agency Language: English Retrieved on: 20-January-2014
/22/	Nexant: Chem systems program – Propylene Oxide 07/08-6 of November 2008 submitted on 15/01/2014.
/23/	Website: http://www.nexant.com/ Argument: About Nexant Language: English Retrieved on: 20-January-2014
/24/	Website: http://www.ipcc-nggip.iges.or.jp/public/2006gl/ Argument: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Language: English Retrieved on: 20-January-2014
/25/	CDM Executive Board: Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the efficiency of the boiler, version 01 of 17-July-2009.
/26/	South Pole Carbon (Thailand) Co. Ltd: Request for validation dated 20/12/2013
/27/	Email dated 18/09/2011 from Mr. Andrew Liveris, Chief Operating Officer, Dow Chemicals Limited on commissioning of the plant
/28/	Website: http://www.dow.com/polyurethane/news/2012/20120104a.htm Argument: Dow's Newsletter dated 04-January-2012- Publicly available Language: English Retrieved on: 20-October-2014

/29/	Industrial Estate Authority of Thailand: Notification certificate - HPPO-2011_Notification No.029-2554 dated:3-October-2011
/30/	Website: http://www.dow.com/ Argument: Dow Chemical Website Language: English Retrieved on: 20-October-2014
/31/	Email dated 04-July-2014 from Mr. Trirat Wisetrat, HPPO Technology Centre Associate on life time of the plant.
/32/	CDM Executive Board: Tool to determine the remaining lifetime of equipment, version 01, dated 16-October-2009
/33/	Website: http://www.pcd.go.th/info_serv/en_regulation.html . Argument: Pollution control department, Ministry of Natural Resources and Environment Language: English Retrieved on: 20-October-2014
/34/	Website: http://www.adityabirlachemicals.com/products/chlor_alkali/companies_producing_chlor_alkalis.html . Argument: Evidence for Chloro-Alkali Production in Thailand Language: English Retrieved on: 20-October-2014
/35/	Website: http://www.dow.com/investors/joint_venture/scgdow.htm Argument: SCG_DOW group website Language: English Retrieved on: 20-October-2014
/36/	Website: http://www.markit.com/sites/en/products/environmental/markit-environmental-registry-public-view.page Argument: Gold Standard Registry Public view Language: English Retrieved on: 20-October-2014
/37/	Website: http://cdm.unfccc.int/Projects/Validation/index.html Argument: CDM – List of projects requesting registration Language: English Retrieved on: 20-October-2014
/38/	Extract of Design details of the project, available as part of project boundary in the VCS-PD /01/ submitted by Mr. Trirat Wisetrat, HPPO Technology Centre Associate, by email dated 14-August-2014.
/39/	Website: http://www.glow.co.th/index.php?op=partner_ourcustomer-index Argument: Glow Grid is connected to the National Grid Language: English Retrieved on: 20-October-2014
/40/	Website: http://www.glow.co.th/index.php?op=about-about_overview Argument: Glow Energy supplies electricity from its Cogeneration plants Language: English Retrieved on: 20-October-2014
/41/	Dietmar Kahlich, Uwe Wiechern, Jörg Lindner: “Propylene Oxide” in <i>Ullmann's Encyclopedia of Industrial Chemistry</i> , 2002 by Wiley-VCH, Weinheim. Article Online Posting Date: June 15, 2000

/42/	SRI Consulting: Process Economics Program Review No.2009-4, Propylene Oxide by the BASF-DOW process by Marcos Nogueira Cesar of December 2009.
/43/	CDM Executive Board: Guidelines on additionality of first-of-its-kind project activities, version 02.0 dated 13-September-2012
/44/	Website: http://ec.europa.eu/competition/mergers/cases/decisions/m2355_en.pdf Argument: Dow , Enichem Polyurethane merger Language: English Retrieved on: 20-October-2014
/45/	EKA Chemicals: Certified Environmental Product Declaration (EPD) for Hydrogen peroxide (H ₂ O ₂) – Undated.
/46/	Website: http://www.specialchem4coatings.com/news-trends/displaynews.aspx?id=3460 Argument: Petronas Chemicals Methanol Sdn Bhd, uses Lurgi's MegaMethanol technology Language: English Retrieved on: 20-October-2014
/47/	Website: http://en.wikipedia.org/wiki/Petronas_Methanol Argument: Petronas Chemicals Methanol Sdn Bhd Mega Methanol plants are of higher capacity Language: English Retrieved on: 20-October-2014
/48/	RINA – SPCTCL: Request for Validation dated 20-December-2013
/49/	Website: http://www.tgo.or.th/english/index.php?option=com_content&view=article&id=178:thailand-grid-emission-2010-report&catid=50:tgos-research-projects&Itemid=40 Argument: Thailand Greenhouse Gas Management Organization (Public Organization), Published Grid Emission factor. Language: English Retrieved on: 20-October-2014

2.3 Interviews

On 06/05/2014, RINA visited the project activity located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand to resolve questions and issues identified during the document review and to perform interviews with relevant stakeholders in the host country.

The key personnel interviewed and the main topics of the interviews are summarized in the table below.

	Date	Name and Role	Organization	Topic
/a/	06/05/2014	Mr.Patana Surawatanapongs Business Development Manager (Thailand)	SPCTCL	Baseline and Additionality Emission reductions calculations Monitoring plan and monitoring arrangements Environmental and social impacts
/b/	06/05/2014	Mr. Sandeep Kanda Tech. Portfolio Director	SPCTCL	Baseline and Additionality Emission reductions calculations Monitoring plan and monitoring arrangements Environmental and social impacts
/c/	06/05/2014	Mr. Trirat Wisetrat HPPO Technology Centre Associate	MHMCL	Overview of production of PO using HPPO process, Reagent receipt, Storage, Production, Waste treatment, Disposal, Energy use. Storage of final product and Shipment. Monitoring plan and monitoring arrangements
/d/	06/05/2014	Mr.Chaiwut, Atthawethworawuth Government Affairs Manager	MHMCL	Local stakeholder consultation process, Environmental and social impacts. Statutory requirements Permits, International operations.

2.4 Site Inspections

As mentioned above RINA visited the project site on 06/05/2014 located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand.

Representatives of project owner and South Pole Carbon (Thailand) Co. Ltd., were interviewed on the applicability of the methodology, eligibility criteria, baseline scenario, and project boundary. The project activity is located in a designated industrial estate, with a number of large scale industries. There were no hindrances during the site visit and all equipment was accessible. The project activity is located in an industrial complex which produces PO and other chemicals. The project activity is confined only to the PO production process. The electricity and heat energy (steam) required for the project activity are purchased. The monitoring plan and the monitoring system implemented and the quality control and quality assurance procedures were confirmed through the onsite observation and interviews.

2.5 Resolution of Findings

The objective of this phase of the validation is to resolve any outstanding issues, which need to be clarified for RINA's positive conclusion on the project design.

To guarantee transparency a validation protocol has been customized for the project. The protocol shows in a transparent manner the requirements, means of validation and the results from validating the identified criteria. The validation protocol consists of three tables; the different columns in these tables are described in the figure below (see Figure 1). The completed validation protocol is enclosed in Appendix A to this report.

A corrective action request (CAR) is raised if one of the following occurs:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions.
- The VCS Version 3 requirements have not been met.
- There is a risk that the emission reductions cannot be monitored or calculated.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable VCS Version 3 requirements have been met.

Figure 1 VCS Validation Protocol Tables

Validation Protocol, Table 1 - Requirement checklist				
Checklist Question	Ref.	MoV	Comments	Conclusion
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organized in five different sections.	Makes reference to documents where the answer to the checklist question or item is found.	Explain how conformance with the checklist question is investigated. Examples are document review (DR), interview or any other follow-up actions (I), cross checking (CC) with available information relating to projects, (N/A) means not applicable.	The discussion on how the conclusion is arrived at and the conclusion on the compliance with checklist question so far.	For CAR, CR and FAR see the definitions above. OK is used if the information and evidence provided is adequate to demonstrate compliance with CDM/VCS requirements.

Validation Protocol, Table 2 - Resolution of Corrective Action Requests and Clarification			
Corrective action requests and/or clarification requests	Reference to Table 1	Response by project participants	Validation Conclusion
The CAR and/or CLs raised in table 1 are repeated here.	Reference to the checklist question number in Table 1 where the CAR or CR is explained.	The responses given by the project participants to address the CARs and/or CRs.	The validation team's assessment and final conclusion of the CARs and/or CRs.

Validation Protocol, Table 3 - Forward Action Requests (if no FAR the table 3 is deleted)		
Forward action request	Reference to Table 1	Response by project participants Validation Conclusion
The FAR raised in table 1 is repeated here.	Reference to the checklist question number in Table 1 where the FAR is explained.	Response by the project participants on how forward action request will be addressed prior to first verification.

2.6 Forward Action Requests

No FAR is raised during the validation.

3 VALIDATION FINDINGS

3.1 Project Details

The project is a Greenfield installation to produce Propylene Oxide (PO) using innovative Hydrogen Peroxide to Propylene Oxide (HPPO) technology. As compared to the conventional processes based on Chlorohydrin technology, the HPPO technology reduces overall energy consumption, thus resulting in significant emission reductions. Furthermore, the HPPO technology diminishes the wastewater volume also significantly, and decreases the infrastructure requirements and physical footprint by using simpler raw material and avoiding co-products. The new HPPO production facility has a production capacity of 390 kilotons per annum of PO /28/.

As per applied methodology/10/ and the VCS-PD/01/, there are 2 (two) classes of emissions that are considered in the proposed project activity, they are up-stream emissions and on-site process emissions. Up-stream emissions will relate to type of reagents used in the chemical reaction in the baseline and project activities while the on-site emissions includes emission sources located within the PO production facility and include emissions associated with the synthesis of the PO as well as emissions associated with by-product and waste treatment. Both emissions are considered in the project activity and baseline.

The technical lifetime of the project activity is 30 years based on technology provider confirmation /31/. Since DOW themselves have put up this plant /28/ and have operated many such propylene oxide plants /30/ and that the crediting period is 10 years, this is being accepted in in line with the Tool to determine the remaining lifetime of equipment /32/. The project activity falls under the Sectoral Scope 5, chemical industry. As confirmed during the site visit, the project is a single project activity and not a grouped project. The project activity is not a de-bundled component of a large-scale project.

RINA was able to verify all the documented evidence listed above during the validation process and can confirm that data and considerations are complete and accurate.

RINA confirms that the description of the proposed VCS project activity, as contained in the VCS-PD sufficiently covers all relevant elements, is accurate and complete and that it provides the reader with a clear understanding of the nature of the proposed VCS project activity.

Project proponent

The project proponents and their responsibility are clearly defined under Section 1.3 of the VCS PD version 02 /01/. MTP HPPO Manufacturing Co., Ltd., is the project owner and South Pole Carbon (Thailand) Co., Ltd. is the project carbon consulting company.

Project start date

The starting date of project activity is defined as 04-October-2011 that has been taken as the actual commissioning date of the new HPPO technology at MTP HPPO Manufacturing Co., Ltd. as confirmed through the Dow Chemicals' News letter dated 04-January-2012 /28/ and Notification certificate dated 03-October-2011 /29/ and it is in line with the VCS Standard /7/.

Project crediting period

The project crediting period is 10 years fixed starting from 04-October-2011 up to 03-October-2021.

Project scale and estimated GHG emission reductions or removals

The estimated average annual emission reductions from the project are estimated to be on the average 239,356 tCO₂e per year over the selected 10 year crediting period /01/.

Projects are categorized by size according to their estimated average annual emission reductions or removals according to VCS Standard /7/. Since the estimated annual emission reductions resulting from the project is less than 300,000 tCO₂e, the category of the project is defined as "Project" as per the VCS Standard /7/.

Project location

The project activity is located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand. The coordinate of the production facility are Latitude: 12.7342 (12° 44' 03" N); Longitude 101.0485 (101° 02' 54" E) as confirmed through the Dow website /13/, Notification certificate dated 03-October-2011 /29/ and the coordinates measured at site.

Conditions prior to project initiation

This is a Greenfield project activity by MTP HPPO Manufacturing Co., Ltd. /01/

Project compliance with applicable laws, statutes and other regulatory frameworks

The project is under the compliance of the relevant local laws and regulations and is not prohibited by any of the national/state level sectoral policies /33/ /34/. Further, the consent to operate the plant and No Objection Certificate /29/ has been received from Pollution Control Board of Thailand, which is the required statutory authority.

Ownership and other programs

Right of use: The ownership of the emission reductions will belong to MTP HPPO Manufacturing Co., Ltd. as confirmed through the proof of ownership of the production facility /35/.

Emissions trading programs and other binding limits: Net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or for meeting binding limits on GHG emissions as confirmed in the VCS-PD /01/

Other forms of environmental credit sought or received: The project has not created another form of Environmental Credit /01/

Participation under other GHG programs: The project has not been registered or seeking registration under other GHG programs as confirmed through the CDM / GS websites /36/ /37/. Also it is to be noted that this project activity is using the new VCS methodology /10/.

Rejection by other GHG programs: The project has not been rejected by other GHG programs as confirmed through the CDM and GS project data base /36/ /37/.

Additional information relevant to the project

Eligibility criteria for grouped projects:

The project is not a grouped project /01/.

Commercially sensitive information:

No commercially sensitive information has been excluded from the public version of the project description /01/.

Any further information:

Not applicable.

3.2 Application of Methodology

3.2.1 Title and Reference

The Approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013 /10/ is correctly applied for the project activity.

Also, following tools have been applied as referred by the Methodology /10/

“Tool for the demonstration and assessment of additionality”, Version 7.0 /14/;

“Tool to calculate the emission factor for an electricity system”, Version 4.0 /16/;

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”, Version 2 /17/.

3.2.2 Applicability

The proposed project activity meets the criteria defined in the baseline methodology as it ensures that:

- The project activity is a Greenfield facility /28/ and produces PO as the only output /22/ /38/.
- The project activity produces no co-products but there are some by-products emitted /22/ /38/.
- The project activity produces no significant by-products /22/ /38/
- The project activity employs the HPPO technology and it is identified that the baseline scenario of this project activity is Chlorohydrin-Chlor-Alkali process /01/ /22/ /38/.
- The project activity takes place in a production facility owned by MTP HPPO Manufacturing Co., Ltd., located in Thailand, confirmed from the PP’s website. /13/.

- The application of the above referred tools has been carried out using the stepwise approach provided in the respective tools./14/-/17/. There are no requirements stated in the tools other than already indicated in the methodology /10/.

RINA hereby confirms that the selected baseline and monitoring methodology has been previously approved by the CDM Executive Board, and is applicable to the Project, which complies with all the applicability conditions therein.

3.2.3 Project Boundary

The project boundary is clearly defined in accordance with the applied Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013 /10/ the project boundary includes PO manufacturing plant from reagents admission to the treatment of by-products and waste from process. The project boundary encompasses also the project electricity system(s) and Heat/steam generation system that the PO plant is connected to. The spatial extent of the project electricity system consists of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. The project is connected to the Glow grid which in turn is connected to the national grid /39/. Therefore, the national grid is considered as the ultimate connected grid. The spatial extent for the heat (steam) system is similar, including the heat/steam generating systems that are physically connected to the project activity and that can be displaced without significant constraints. The heat (steam) requirements of the project are met by the steam extracted from the cogeneration plants of Glow grid /40/. As the emissions get accounted in the electricity component therefore to avoid possible double counting and applying conservative principle the emission factor for steam has been considered as zero /40/. This is accepted as the baseline thermal energy consumption is higher than that of the project thermal energy consumption /22/ /38/. The fuel requirement is for incineration purpose. Natural gas is being used as the fuel /38/, also confirmed during site visit.

Emissions sources included in the project boundary are shown in the table below and found to be consistent with the applied methodology /10/:

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions associated with the production of baseline reagents	CO ₂	Yes	The emissions associated with Cl ₂ and NaOH (Chlor-Alkali) production have been accounted as these are generally not found naturally and are to be produced in an industrial facility. The emissions associated with C ₃ H ₆ has however not been accounted as its usage would be essentially the same as in the project activity.
		CH ₄	No	Excluded for simplification, this is conservative.
		N ₂ O	No	Excluded for simplification, this is conservative.
	Emissions associated with steam	CO ₂	Yes	Emissions could arise from the combustion of fossil fuels for providing steam and/or electricity to the PO production facility

Source		Gas	Included?	Justification/Explanation
	and electricity requirements of the production process	CH ₄	No	Excluded for simplification, this is conservative.
		N ₂ O	No	Excluded for simplification, this is conservative.
	Emissions associated with treatment of waste produced by the production process	CO ₂	No	Emissions could arise from the incineration of waste. This source has been excluded for conservativeness and simplification. /10/
		CH ₄	No	Excluded for simplification, this is conservative.
		N ₂ O	No	Excluded for simplification, this is conservative.
Project	Emissions associated with the production of project reagents	CO ₂	Yes	The emissions associated with H ₂ O ₂ production and solvent (make-up) have been accounted for as these reagents are generally not found naturally and are produced in an industrial facility. The emissions associated with C ₃ H ₆ have, however, not been accounted for as its usage would be essentially the same as in the baseline activity.
		CH ₄	No	Excluded for simplification, this is conservative.
		N ₂ O	No	Excluded for simplification, this is conservative.
	Emissions associated with steam and electricity requirements of the process	CO ₂	Yes	Emissions could arise from the combustion of fossil fuels for providing steam and/or electricity to the PO production facility
		CH ₄	No	Excluded for simplification, this is conservative.
		N ₂ O	No	Excluded for simplification, this is conservative.
	Emissions associated with treatment of waste produced by the production process	CO ₂	Yes	Emissions could arise from the incineration of waste (e.g., low boils, waste gas, etc.). For simplification this source has been excluded as the waste generation is lesser in quantity and carbon intensity as compared to baseline. Also assuming that the fossil fuel consumed in the incinerator is the same as in the baseline.
		CH ₄	No	Excluded for simplification, this is conservative.

Source	Gas	Included?	Justification/Explanation
	N ₂ O	No	Excluded for simplification, this is conservative.

By checking the information by the physical site, RINA can confirm that all the emission sources, gases have been included in the project boundary, and the description in the VCS PD is accurate and complete, and also that the selected sources and gases are justified for the proposed project activity.

3.2.4 Baseline Scenario

Project follows the steps as detailed in methodology applied /10/

Step 1: Identification of plausible alternative scenarios

The plausible alternative scenarios to the project activity are as follows:

P1: The project activity without carbon revenues;

P2: A PO production facility with comparable capacity using a CHPO process (CHPO-lime or CHPO-chlor-alkali processes);

P3: A PO production facility with comparable capacity using any other commercially available technology.

As the project activity produces PO as its only output therefore other processes wherein co-products are getting produced for e.g., CHP, POSM, POTBA are not considered as likely alternatives /41/ /42/. This approach is consistent with the methodology applied /10/. The lime process has higher cost of production /22/ hence not considered. Thus, only Chlorohydrin-Chloro-Alkali process is considered as a likely alternative. Further, there is no other commercially available technology /22/ so option P3 is eliminated.

Therefore the likely realistic and credible alternatives to the project activity are:

P1: The project activity without carbon revenues; and

P2: A plant with the same capacity using the Chlorohydrin process (Chloro-Alkali).

Step 2: Consistency with mandatory applicable laws and regulations:

Cross verified with publicly available sources, while there are no PO plants in Thailand other than the project activity, there is no evidence that CHPO based PO plants are not permitted in Thailand. The general legal requirements for putting up a plant / environmental laws were checked /33/. Further, there is also a Chlor-Alkali plant in Map Ta Phut /34/. The project activity has secured approval and has been installed /29/, hence it is accepted that both the alternatives are complying with mandatory applicable laws and regulations.

The project activity demonstrates to be the first-of-its-kind and further uses barrier analysis to demonstrate baseline and additionality, detailed in section 3.2.5 below.

3.2.5 Additionality

Project uses the “Tool for the demonstration and assessment of additionality” /14/ to determine the additionality of the project, consistent with the methodology /10/ applied.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

The project activity is first-of-its-kind and involves feedstock as well as technology switch. The Guidelines on additionality of first-of-its-kind project activities, Version 02.0 /43/ has been followed, to demonstrate that the project is a ‘first-of-its-kind’.

The project is implemented in Thailand. As prior to the project activity there has been no PO production in Thailand, therefore a larger area comprising of the Asia Pacific region has been considered as the applicable geographical area.

Within the Asia Pacific region, Japan, Singapore and China are main producers of PO, together representing over 85% of total capacity. The remaining portions of the total capacity are produced by PO plants in South Korea and India. The POSM and chlorohydrin processes dominate the PO production within Asia Pacific with the POSM route contributing about half of the regions total capacity. As POSM also results in co-products /42/ therefore it is not considered as an alternative. The project is first of its kind in the region as is evident from the table on Asia Pacific PO capacity indicated in the Nexant report on Propylene Oxide /22/. Since the project demonstrates additionality by being first of its kind, the crediting period is therefore restricted to fixed 10 years /43/.

It is accepted that the project is the first of its kind in the applicable geographical area as the project is the first in the applicable geographical area that applies HPPO technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the start date of the proposed project activity /22/. The project implements the measures involving both feedstock as well as technology switch. The project participants selected a crediting period for the project activity that is “a maximum of 10 years with no option of renewal”.

Although the project has been demonstrated to be the first-of-its-kind, the PP chose to consider following barriers also.

Technological barriers:

The Chlorohydrin process is the most conventional technology for PO production /22/ /41/ /42/. An analysis on the existence of this technological barrier is done by the PP based on the market penetration of different PO production technologies within the following three different regions as follows: (1) geographic locations of Dow’s PO plants around the globe, (2) in the Host country (Thailand), and (3) World PO market as a whole.

(1) Referring to the Nexant Report on HPPO /22/, Dow is a major player in the PO market (holding over 25% of total market share). The company has in total 5 PO plants around the globe, with total nameplate capacity of 2,045 kT/year. Chlorohydrin process represents the most widely practiced process to produce PO, with 4 out of 5 existing Dow plants (with a totalling

capacity of 1,895 kT/year) producing PO with chlorohydrin technology. Relative to total production capacity, the Chlorohydrin technology is the dominating production process in Dow, holding a share of an approximate 93%. Only in 2001 that Dow has initiated a laboratory study on HPPO technology when it acquired its hydrogen peroxide technology through the purchase of EniChem's polyurethane business /44/. The development of such technology on a commercial basis began in 2003 when Dow and BASF began their joint research program. The collaboration allowed the companies to start examining each other's processes and in 2008, together they have announced the start-up of their first HPPO plant in Antwerp, Belgium. Dow's ownership of 150 kT capacity of this HPPO plant constitutes 7% technological share of its total production capacity.

(2) Within the Asia Pacific region, Japan, Singapore and China are main producers of PO, together representing over 85% of total capacity, out of which none of them are HPPO based. The remaining portions of the total capacity are produced by PO plants in South Korea and India. Currently, PO is not produced in Thailand. PO is imported and consumed in Thailand for the production of Polyols /22/.

(3) 'World' is considered as a region for analysis: The capacity share of the HPPO technology is still only at 4.9% of the World's PO production capacity. Thus, with reference to the "Guidelines for Objective Demonstration and Assessment of Barriers", version 1 /18/, the HPPO technology can be seen as being marginal as it represents less than 10% in the PO industry. Such barrier is not applicable for CHPO process, where its 43.2% share of the World's PO production capacity represents a majority and is an indication that the Chlorohydrin process is the prevailing practice in the PO industry /22/.

Owing to the above stated barriers it is accepted that the conventional CHPO technology would be the likely alternative and thus only realistic and credible baseline scenario to the proposed project activity.

The registration of the VCS project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the VCS: it will provide additional revenues for the project, which are needed to mitigate the additional risks raised by the identified barriers, thus would help to develop this new and un-experienced technology in Asia and more particularly in Thailand.

Step 4. Common Practice Analysis

Not applied as the project demonstrates to be a first-of-its-kind /14/.

3.2.6 Quantification of GHG Emission Reductions and Removals

The emission reduction E_R by the proposed project activity during the crediting period is the difference between baseline emissions (BE_y), project emission (PE_y). Justification of the values chosen is available in 3.2.8 of this report.

Baseline Emissions

Baseline emissions for the chosen baseline scenario are calculated as per equation 1 of the methodology /10/ as below:

$$BE_y = BE_{Upstream,y} + BE_{Process,y}$$

Where:

BE_y	Baseline emission in year y (tCO ₂)
$BE_{Upstream,y}$	Emissions associated with the baseline reagents required for the production of PO in year y (tCO ₂)
$BE_{Process,y}$	Emissions due to energy usage (heat and electricity) for transforming the baseline reagents into the final product (PO) and also for waste and by-product treatment in year y (tCO ₂)

Up-stream emissions ($BE_{Upstream,y}$):

The emissions associated with Chlor-Alkali production are calculated as per equation 2 of the methodology /10/ as below:

$$BE_{Upstream,y} = be_{Chlor-Alkali,y} \times PO_y$$

Where:

$be_{Chlor-Alkali,y}$	Quantity of CO ₂ that would be emitted from Chlor-Alkali production per unit of PO in year y (tonnes)
PO_y	Quantity of PO produced in year y (390,000 tonnes)

The CO₂ emissions associated with Chlor-Alkali production are calculated as per equation 3 of the methodology /10/ as below:

$$be_{Chlor-Alkali,y} = \left(\frac{71}{58} \right) \times ec_{Chlor-Alkali,y} \times EF_{EL,y}$$

Where:

$ec_{Chlor-Alkali,y}$	Energy consumption per ton of Cl ₂ production in year y (2.2 MWh/tCl ₂)
$EF_{EL,y}$	Emission factor for electricity generation in year y (0.5113 tCO ₂ /MWh)
71/58	Ratio between the molecular weights of Cl ₂ and C ₃ H ₆ O (mass units/mass)

units)

Hence, Up-stream emissions ($BE_{Upstream,y}$) is calculated to be: 537,024 tCO₂/year

Process emissions ($BE_{Process,y}$):

The emissions associated with energy usage is calculated as per equation 4 of the methodology /10/ as below:

$$BE_{Process,y} = BE_{Heat,y} + BE_{Elec,y} + BE_{Waste,y}$$

Where:

$BE_{Heat,y}$ Emissions due to thermal energy (heat/steam) for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO₂). This is considered zero, conservative, hence accepted.

$BE_{Elec,y}$ Emissions due to electrical energy for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO₂)

$BE_{Waste,y}$ Emissions due to treatment of waste products in year y (tCO₂). This is considered zero, conservative, hence accepted.

The CO₂ emissions from electrical energy are calculated as per equation 7 of the methodology /10/ as below:

$$BE_{Elec,y} = SEC_{CHPO} \times PO_y \times EF_{El,y}$$

Where:

SEC_{CHPO} Specific electrical energy consumption ratio in the PO production through CHPO process (0.100 MWh/tonne of PO).

$EF_{El,y}$ Emission factor for electricity generation in year y (0.5113 tCO₂/MWh)

Hence, process emissions ($BE_{Process,y}$) is calculated to be: 19,959 tCO₂/year and the Baseline emissions is calculated to be: 556,982 tCO₂/year.

Project Emissions

Project emissions are calculated as per equation 9 of the methodology /10/ as below:

$$PE_y = PE_{Upstream,y} + PE_{Process,y}$$

Where:

PE_y	Project emissions in the year y, (tCO ₂)
$PE_{Upstream,y}$	Emissions associated with the project reagents for the production of PO in year y (tCO ₂)
$PE_{Process,y}$	Emissions due to energy usage (heat, electricity etc.) for transforming the project reagents into the final product (PO) and also for waste treatment in year y (tCO ₂)

Up-stream emissions ($PE_{Upstream,y}$):

The emissions associated with H₂O₂ and solvent production solvents are considered, consistent with the methodology applied /10/, design details of the plant /38/ and site visit observations and interviews.

The upstream emissions are calculated as per equation 10 of the methodology /10/ as below:

$$PE_{Upstream,y} = PE_{Upstream,H_2O_2,y} + PE_{Upstream,Solvent,y}$$

The emissions associated with H₂O₂ production are calculated as per equation 11 of the methodology /10/ as below

$$PE_{Upstream,H_2O_2,y} = \left(\frac{34}{58} \right) \times pe_{HP} \times PO_y$$

Where:

peHP Quantity of CO₂ that would be emitted per tonne of H₂O₂ (0.533 tCO₂/tH₂O₂)

PO_y Quantity of PO produced in year y (390,000 tonnes)

34/58 Ratio between the molecular weights of H₂O₂ and C₃H₆O (mass units/mass units)

The emissions associated with make-up solvent are calculated as per equation 12 of the methodology /10/ as below

$$PE_{Upstream,Solvent,y} = pe_{Sol} \times sol_y \times PO_y$$

Where:

peSol Quantity of CO₂ that is emitted per tonne of solvent (0.31 tCO₂/tonne of solvent)

soly Quantity of solvent required per tonne of PO in year y (tonnes)

POy Quantity of PO produced in year y (tonnes)

soly, as found in equation 12 of the methodology /10/ above, is estimated based upon the design details (14,400 tonnes of Methanol/year) /38/ of the project for ex-ante estimations. For ex-post calculations, “soly X POy” is represented by Soly in equation 12 above, the value of which is monitored. Consistent with the methodology, hence accepted.

Hence, PE_{Upstream,y} is calculated to be 126,319 tCO₂/year

Process emissions (PE_{Process,y}):

The process emissions are calculated as per equation 13 of the methodology /10/ as below

$$PE_{Process,y} = PE_{Heat,y} + PE_{Elec,y} + PE_{Waste,y}$$

Where:

PE_{Heat,y} Emissions due to thermal energy (heat/steam) for transforming the project reagents into the final product in year y (tCO₂). This is considered zero as it sourced from Glo Grid, cogeneration plants /40/. This approach is consistent with the approach adopted in baseline. This is also conservative, since the baseline thermal energy consumption is higher than the project scenario /22/

PE_{Elec,y} Emissions due to electrical energy for transforming the project reagents into the final product in year y (tCO₂)

PE_{Waste,y} Emissions due to treatment of waste products in year y (tCO₂)

The CO₂ emissions from electrical energy are calculated as per equation 15 of the methodology /10/ as below

$$PE_{El,y} = SEC_{HPPO,y} \times PO_y \times EF_{El,y}$$

Where:

$SEC_{HPPO, y}$ Specific electrical energy consumption ratio in PO production through the HPPO process in year y (0.513 MWh/tonne of PO)

$EF_{El, y}$ Emission factor for electricity generation in year y (0.5113 tCO₂/MWh)

SEC_{HPPO} , as found in equation 15 of the methodology above /10/, is estimated based upon the design details (390,000 tonnes of PO/year) /38/ of the project for ex-ante estimations. For ex-post calculations, " $SEC_{HPPO} \times PO_y$ " is represented by EC_{HPPO} in equation 15 above, the value of which is monitored.

The emission factor for electricity generation is the same as calculated for the baseline emissions.

Hence, $PE_{Elec, y}$ is calculated to be 102,260 tCO₂/year

The CO₂ emissions from waste treatment are calculated as per equation 16 of the methodology /10/ as below

$$PE_{Waste, y} = \left(\frac{44}{12} \right) \times (CA_{Waste, y}) + FC_{i, y} \times COEF_{i, y}$$

Where:

$CA_{Waste, y}$ Carbon amount in the waste stream derived from the carbon amount in the propylene feed, solvent, PO and by-products in year y (tonnes)

44/12 Ratio between the molecular weights of CO₂ and carbon (mass units/mass units)

$FC_{i, y}$ Quantity of fuel type i combusted in the incinerator in year y (mass or volume unit/year). This is considered zero for ex-ante estimations. Since the use of natural gas is very minimal, just to maintain the pilot flame in the incinerator, this would be the same as in the baseline incinerator. The waste gases to be incinerated are flammable and have already been accounted as project emissions. Ex-post it is monitored and accounted in project emissions.

$COEF_{i, y}$ CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit), calculated as per the Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion /17/

The carbon amount in the waste stream must be calculated as per equation 17 of the methodology /10/ as below

$$CA_{Waste, y} = CA_{Propylene, y} + CA_{Solvent, y} - (CA_{PO, y} + CA_{Byproducts, y})$$

Where:

$CA_{\text{Propylene}, y}$ Carbon amount in the propylene feed in year y (tonnes)

$CA_{\text{Solvent}, y}$ Carbon amount in the solvent used in year y (tonnes)

$CA_{\text{PO}, y}$ Carbon amount in PO produced in year y (tonnes)

$CA_{\text{Byproducts}, y}$ Carbon amount in the by-products in year y (tonnes)

The total amount of carbon in a particular product is a function of the respective carbon fraction and the quantity of the product, expressed as per equation 18 of the methodology /10/ as below

$$CA_{x,y} = ca_{x,y} \times Q_{x,y}$$

Where:

$CA_{x,y}$ Carbon amount in the product x in year y (tonnes)

$ca_{x,y}$ Carbon fraction in the product x in year y (mass units/mass units)

$Q_{x,y}$ Quantity of the product x in year y (tonnes)

v propylene (305,600 tonnes/year), solvent(14,400 tonnes/year), PO (390,000 tonnes/year), by-product (8,800 tonnes/year), waste (input-output is considered waste, conservative and consistent with the methodology applied /10/).

Applying equation 19 of the methodology, the emissions due to treatment of waste products in year y (tCO_2) $PE_{\text{Waste},y}$ is calculated to be 89,047 tCO_2 /year.

Leakage

No leakage emissions are considered consistent with the methodology /10/, design details of the plant /38/ and site visit observations and interviews.

Emission Reductions

Emission reductions are calculated as per equation 20 of the methodology /10/ as below

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year y (239,356 tCO_2e/yr)

BE_y Baseline emissions in year y (556,982 tCO_2/yr)

PEy Project emissions in year y (317,625 tCO₂e/yr)

LEy Leakage emissions in year y (0 tCO₂e/yr)

The annual emission reductions generated by the project activity is calculated to be 239,356 tCO₂e/year over the selected 10 years renewable crediting period.

The estimation of the emission reductions can be replicated using the data and parameter values provided in the VCS-PD /1/ and supporting files /2/. The data sources mentioned have been verified by RINA and confirms that the GHG emissions reduction calculation is complete and transparent, and the data accuracy has been verified.

3.2.7 Methodology Deviations

Not applicable as there are no methodology deviations.

3.2.8 Monitoring Plan

The approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013 /10/ has been applied.

The monitoring plan is in accordance with the monitoring methodology; the monitoring plan will give opportunity for real measurement of achieved emission reductions.

RINA has checked all the parameters presented in the monitoring plan against the requirements of the methodology; no deviations relevant to the project activity have been found in the plan.

RINA confirms that the monitoring arrangements described in the monitoring plan are feasible within the project design, and the means of implementation of the monitoring plan are sufficient to ensure the emission reductions achieved by/resulting from the proposed VCS project activity can be reported ex-post and verified.

Parameters Determined Ex-ante

The ex-ante parameters that are mentioned in the methodology are included in the VCS PD and are provided in compliance with the methodology:

	Data / Parameter	Unit	Value applied	Assessment
1	Energy consumption per tonne of Cl ₂ production in year y. ($ec_{Chlor-Alkali, y}$)	MWh/tCl ₂	2.2	Sourced from Multilateral Investment Guarantee Agency Environmental Guidelines for Chlor-Alkali Industry /20/, a credible independent third party /21/.
2	Specific thermal energy consumption ratio in PO production	TJ/ton of PO	0.003864	Sourced from Nexant report on HPPO /22/, a credible independent third party report /23/. It is to be noted that the PP has chosen to consider baseline

	through the CHPO-chlor-alkali process (SSC_{CHPO})			emissions due to thermal energy consumption as zero, conservative as the baseline energy consumption is higher than that of the project activity /22/ /38/ /2/
3	Specific electrical energy consumption ratio in PO production through the CHPO-chlor-alkali process. (SEC_{CHPO})	MWh/ton of PO	0.100	Sourced from Nexant report on HPPO /22/, a credible independent third party report /23/.
4	Quantity of CO ₂ that would be emitted per ton of H ₂ O ₂ (pe_{HP})	tCO ₂ /tH ₂ O ₂	0.533	Sourced from certified environmental product declaration (EPD) for hydrogen peroxide /45/, reviewed by the Swedish National Testing and Research Institute an accredited certification body. Hence accepted
5	Quantity of CO ₂ emitted per tonne of solvent (pe_{Sol})	tCO ₂ /tonne of solvent	0.310	Sourced from Table 3.12, Chapter 3: Chemical Industry Emissions, IPCC 2006 report /24/, a credible independent third party report. Methanol is sourced from Petronas Chemicals Methanol Sdn Bhd, Rantau-rantau Industrial Estate, Labuan, Malaysia. The plant uses Lurgi's MegaMethanol technology /46/. It is noted that Petronas Methanol (Labuan) Sdn. Bhd. (PMLSB) produces methanol using Lurgi's low-pressure combined technology and the 2nd plant uses Lurgi's MegaMethanol technology, with a capacity of more than double that of the first plant. /47/. The EF for the Lurgi Low Pressure Process technology is 0.267 whereas for Lurgi Mega Methanol Process is 0.310 /24/. Hence accepted.
6	Carbon amount in the waste stream combusted in the incinerator in the baseline per ton of PO ($ca_{Waste, Baseline}$)	tC/ ton of PO	Excluded for simplification	Conservative hence accepted.
7	Quantity of fossil fuel combusted in the incinerator in the baseline per ton	Ratio	Excluded for simplification	Conservative hence accepted.

	of PO production ($fc_{i,baseline}$)		ion	
8	Emission factor for electricity generation in year ($EF_{EL,y}$)	tCO ₂ /MWh	0.5113	Project uses official published data on operating and build margin emission factors. The version of the data used is the latest version available during start of validation /49/. RINA confirms that the start date of validation is 20-December-2013 /48/. The emission factor is calculated according to the latest 'Tool to calculate the emission factor for an electricity system' Version 4.0 /16/ provided by Thailand Greenhouse Gas Management Organization (Public Organization) TGO. Although the emission factor provided by the Thai DNA refers to version 2.2.1 of the tool. However the changes from version 2.2.1 to version 4.0 of the tool do not impact the computation in the context of Thailand. Project participant has applied weightage factors for the OM and BM [75% & 25% respectively] as specified in the tool to arrive at the emission factor for the combined margin /49/. Validation team has checked the emission factor calculations and the value of EF_y, is found to be correct. The validation team agrees to this emission factor since it is based on the official background data. RINA confirms that the database is an official publication of Thailand. The calculation and assumptions were verified by the validation team and found to be correct and appropriate.

Parameters Monitored Ex-post

The ex-post parameters that are mentioned in the methodology are included in the VCS-PD and are provided in compliance with the methodology, and they will be monitored during the crediting period:

	Parameter	Description/Assessment
1	PO_y (tonnes)	Quantity of PO produced in year y, sourced from plant production records, measured using vortex flow meters, continuously monitored, integrated daily and recorded at least once a month. The values can be cross checked with stock verification records. The meters used will be calibrated regularly according to manufacturer's guidelines. The approach used in the project activity is consistent with the methodology applied /10/, hence accepted.
2	Sol_y (Tonnes)	Quantity of make-up solvent used in year y. Sourced from plant records, measured using vortex flow meters, continuously monitored, integrated daily and recorded at least once a month. The values can be cross checked with stock verification records. The meters used will be calibrated regularly according to manufacturer's guidelines. The approach used in the project activity is consistent with the methodology applied /10/, hence accepted.
3	$EFCO_{2,i,y}$ (tCO ₂ /TJ)	Weighted average CO ₂ emission factor of fossil fuel used during year y. Natural gas is the only fossil fuel used on site for incineration of wastes. The emission factor is sourced from IPCC data (56.1) /24/. Monitored annually. Consistent with the requirements of the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion" /17/ and the methodology /10/. Hence accepted.
4	$\eta_{Boiler,y}$ (%)	Efficiency of the steam generating system. 100%, most conservative value as it is applied both in baseline and project scenarios since the energy consumption is baseline is more than that of the project activity /22/. It is to be noted that thermal energy consumption is considered zero in both project and baseline scenarios.
5	$SC_{HPPO,y}$ (TJ)	Thermal energy consumption in the PO production through HPPO process in year y. Data shall be taken from the meters calibrated regularly according to manufacturer's guidelines. Steam consumption would be converted conservatively into energy terms using enthalpy values and accounting for any condensate return. Cross-checking with thermal energy purchase receipt from the thermal energy supplier. The energy consumption is baseline is more than that of the project activity /22/. It is to be noted that thermal energy consumption is considered zero in both project and baseline scenarios.
6	$EC_{HPPO,y}$ (MWh)	Electrical energy consumption in the PO production through HPPO process in year y. Sourced from plant records,

		measured using electricity meters, continuously monitored, integrated daily and recorded at least once a month. The average specific electrical energy consumption to be calculated based on PO production. The meters used will be calibrated regularly according to manufacturer's guidelines. The approach used in the project activity is consistent with the methodology applied /10/, hence accepted.
7	$Q_{\text{Propylene},y}$ (Tonnes)	Quantity of propylene used in year y. Sourced from plant records, measured using mass flow meters, continuously monitored, integrated daily and recorded at least once a month. The values can be cross checked with stock verification records. The meters used will be calibrated regularly according to manufacturer's guidelines. The approach used in the project activity is consistent with the methodology applied /10/, hence accepted.
8	$Q_{\text{By-product},y}$ (Tonnes)	Quantity of by-product produced in year y. Sourced from plant records, measured using vortex flow meters, continuously monitored, integrated daily and recorded at least once a month. The values can be cross checked with stock verification records. The meters used will be calibrated regularly according to manufacturer's guidelines. The approach used in the project activity is consistent with the methodology applied /10/, hence accepted.
9	$FC_{i,y}$ (Mass or volume units)	Quantity of NG combusted in the incinerator during the year y, sourced from supplier data, Measured through turbine meter. The meter belongs to PTT and installed on PTT skid.
10	$COEF_{i,y}$ (tCO ₂ /tonne of Natural gas)	CO ₂ emission coefficient of Natural gas. Sourced from IPCC data /24/. Monitored annually. Consistent with the requirements of the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion" /17/ and the methodology /10/. Hence accepted.

3.3 Non-Permanence Risk Analysis

Validation did not reveal any non-permanence risk for the project activity.

3.4 Environmental Impact

The project activity is environmentally licensed by the competent authority /29/. Environmental Impact Assessment (EIA) has been prepared and such a report is be approved by the Office of Environmental Policy and Planning (OEPP) and National Environmental Board (NEB) according to the Thai regulations.

None of the environmental impacts identified are considered significant by project stakeholders, and the report has been approved by Thai government.

3.5 Comments by Stakeholders

A stakeholder consultation was conducted before the implementation of the proposed VCS project activity on the 3-February-2010 as part of the EIA. Extracts from the EIA on stake holder consideration has been included in the VCS-PD, the same was confirmed during site visit. The invitation letters were sent out as well as announcements were made publicly. In addition, the project also organized several following up group consultation in order to make sure that most of relevant stakeholders had expressed their opinion and concern on the project. The results of such public hearings were positive. Hence the project was approved with environmental license /29/.

4 VALIDATION CONCLUSION

RINA Services Spa (RINA) has performed validation of the project activity “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, with regard to the relevant requirements for VCS Version 3 activities.

The review of the VCS-PD and the subsequent follow-up interviews have provided RINA with sufficient evidence to determine the fulfillment of the stated criteria.

The project correctly applies the approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013.

By usage of lesser GHG intensive reagents and reduced process energy requirements in the HPPO technology, the project results in reduction of CO₂ emissions that are real measurable and giving long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” are estimated to be on average 239,357 tCO₂e per year over the selected 10 years renewable crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design and it is RINA's opinion that the project participants are able to implement the monitoring plan.

In conclusion, it is RINA's opinion that the project activity “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, as described in the VCS PD version 02 of 22-September-2014, meets all relevant UNFCCC and VCS Version 03 requirements for the VCS VER and all relevant host Party criteria and correctly applies the Approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013.

APPENDIX A

VALIDATION PROTOCOL

TABLE 1 REQUIREMENTS CHECK LIST

Checklist Question		Reference	MoV ¹	Comments	Conclusion
A Description of Project Activity					
A.1 Title of the project activity					
A.1.1.	Does the used project title clearly enable the reader to identify the unique VCS activity? Are there an indication of a revision number and the date of the revision?	/1/	DR	The project title is “Reduction of GHG Emissions in Propylene Oxide Production at MTP HPPO Manufacturing Co., Ltd.” The above information is available transparently in the VCS PD version number 00 dated 06-January-2014	OK
A.1.2	Does the project comply with the applicable requirements for completing the VCS PD (latest version available)?	/1/, /3/, /4/	DR	<i>PP is requested to update all relevant documents with respect to the latest VCS program guide version 3.5 and VCS standard version 3.4 dated 08-October-2013.</i>	CAR1 OK
A.1.3	Does the VCS PD comply with the template available (latest version)?	/1/, /3/, /4/, /5/	DR	<i>PP is requested to use the latest version of the VCS–PD template, please refer to section A.1.2 above</i>	CAR1 OK
A.2 Description of the proposed project activity					
A.2.1	Does the VCS PD contain an accurate description of the project activity and provide the reader with a clear understanding of the precise nature of the project activity and the technical aspects of its implementation? How was the design of the project assessed?	/1/, /4/, /5/	DR	The project is a Greenfield installation to produce Propylene Oxide (PO) using Hydrogen Peroxide to Propylene Oxide (HPPO) technology. As compared to the conventional processes based on Chlorohydrin technology, the HPPO technology reduces overall energy consumption, thus resulting in emission reductions. Up-stream emissions and on-site process emissions are considered in arriving at the emission reductions due to the project activity. Up-stream emissions relates to type of reagents used in the chemical reaction in the baseline and project activities while the on-site emissions includes emission sources located within the PO production facility and include emissions associated with the synthesis of the PO as well as emissions associated with by-product and waste	CL1 OK

¹ MoV: DR document review, I interview, CC cross checking

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			treatment. This approach is consistent for both project activity and baseline. Consistent with the methodology adopted, hence accepted. However, <i>PP</i> is requested to clarify the following: 1. <i>Production capacity is mentioned to be 430 kilotons per annum of PO. PP is requested to submit evidence for the production capacity of the project plant.</i> 2. <i>PP is requested to submit the purchase order and the commissioning certificate for the project activity.</i> 3. <i>As required by the VCS PD template, PP is requested to include the list and arrangement of the main manufacturing / production technologies, systems and equipments involved.</i> 4. <i>PP is requested to include the types and levels of services in terms of mass or energy flows provided by the systems and equipment that are being installed and their relation, if any, to other manufacturing/production equipment and systems outside the project boundary. PP is also requested to clearly explain on how the same types and levels of services provided by the project would have been provided in the baseline scenario</i> 5. <i>While it is transparent in the VCS PD that the project activity is a green field project, as it is situated in a manufacturing complex involving production of chemicals other than PO, PP is requested to confirm on the list of facilities / shared facilities, systems and equipment in operation under the existing scenario prior to the implementation of the project and would be used in the project scenario.</i>	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
A.2.2	Does the project activity involve alteration of existing installations? If yes, have the differences between pre-project and post-project activity been clearly described in the VCS PD?	/1/, /4/, /5/	DR	This is a green field project, however PP is requested to refer to section A.2.2 above	~~CL1~~
A.2.3	Is all information provided consistent and in compliance with the actual situation or planning?	/1/, /4/, /5/	DR	Please refer to section A.2.2 above	~~CL1~~ OK
A.3 Project proponent					
A.3.1	Does VCS PD provide contact information and roles/responsibilities for the project proponent(s)?	/1/, /4/, /5/, /26/	DR	VCS PD gives contact information and roles/responsibilities for the project proponent; however PP is requested to submit appropriate evidence in support of the same. As per the VCS PD the PP is South Pole Carbon Asset Management Ltd., however the contract / request for validation has been signed by South Pole Carbon (Thailand) Co. Ltd, PP is requested to clarify this difference.	~~CL2~~ OK
A.4 Technical description of the project					
A.4.1	Does the information provided on the location of the project activity allow for a clear identification of the site(s)?	/1/, /4/, /5/, /13/	DR / CC/ I	The project activity is located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand, confirmed with PP's website and during site visit	OK
A.4.2	Is the category(ies) of the project activity correctly identified?	/1/, /2/, /4/, /5/	DR	The project activity belongs to sectoral scope 5, consistent with the methodology applied, hence accepted. The project activity takes place in a single site, hence not a grouped project activity. The project is estimated to achieve an emission reduction of more than 300,000 tones of CO₂e per year, however has been categorized as project as per section 1.7 of the VCS-PD, PP is requested to correct the VCS-PD as appropriate.	~~CAR2~~ OK
A.4.4	What is the expected operational lifetime of	/1/, /2/,	DR	Lifetime of the project activity is mentioned to be	~~CL1~~ OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
	the project activity? Is it reasonable?	/4/, /5/		30years in the VCS PD, PP is requested to submit evidence for the same.	
A.5 Public funding					
A.5.1	Does the information on public funding provided conform to the actual situation or planning as presented by the PPs?	/1/, /2/, /4/, /5/	DR, I	PP is requested to confirm on the source of funding for the project activity.	GL3 OK
A.5.2	If public funding from Parties included in Annex I is used for the project activity, have these Parties provided an affirmation that such funding does not result in a diversion of official development assistance, is separate from, and is not counted towards the financial obligations of these Parties?	/1/, /2/, /4/, /5/	DR	The project activity is a voluntary emission reduction project, which is developed under VCS; hence, the transfer of technology from any Annex I Party is not applicable.	OK
B. Application of a baseline and monitoring methodology					
B.1 Methodology applied					
B.1.1	Does the project activity apply an approved methodology and the correct version thereof?	/1/, /3/, /4/, /5/, /10/	DR	The proposed project activity applies approved VCS methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production" version 1.0 of 09-September-2013" as indicated in the VCS PD. The applied methodology is approved by the VCSA and the latest version at the time of submission of the VCS PD for the project activity.	OK
B.1.2	Is there any specific guidance, including the methodological tools provided by EB and has these guidance been applied?	/1/, /3/, /4/, /5/, /10/, /14/ - /17/	DR	The following CDM EB methodological tools have been used in the project activity; this is consistent with the VCS methodology applied. 1. Tool for the demonstration and assessment of additionality 2. Tool to calculate the emission factor for an electricity system 3. Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion. 1. PP is requested to transparently mention the	GL4 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion																								
				<i>version number of the tools used.</i> 2. <i>VCS-PD does not refer to the Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the efficiency of the boiler.</i>																									
B.1.3	How was it validated that the project activity complies with the applicability criteria?	/1/, /3/, /4/, /5/, /10/, /13/	DR	<table><tr><th colspan="3">Applicability of the VCS Methodology AM0023:</th></tr><tr><th>Applicability criteria</th><th>Project activity</th><th>Criteria are met?</th></tr><tr><td>The methodology is limited to green field projects (i.e., new PO production facilities) wherein PO is the only output.</td><td>1. <i>PP is requested to provide PO copy.</i> 2. <i>PP is requested to provide mass balance as from the supplier of the plant / 3rd party report.</i></td><td>CL4</td></tr><tr><td>The PO production process must not produce any co-products. There may be by-products produced in the PO production process, due to the selectivity of catalysts.</td><td>PP is requested to provide mass balance as from the supplier of the plant / 3rd party report.</td><td>CL4</td></tr><tr><td>The PO production process must not create more than 10% (in mass terms) by-product, relative to PO output.</td><td>PP is requested to provide mass balance as from the supplier of the plant / 3rd party report.</td><td>CL4</td></tr><tr><td>The methodology is applicable only to projects where the project activity is the implementation of the HPPO process and where implementation of the CHPO-chlor-alkali process is identified as the baseline scenario.</td><td>As detailed in the VCS-PD, the project activity employs the HPPO technology and it is identified that the baseline scenario of this project activity is Chlorohydrin-Chlor-Alkali process.</td><td>OK</td></tr><tr><td>The project may be located in any geographic region of the world.</td><td>The project activity is located in Thailand, confirmed from the PP's website.</td><td>OK</td></tr><tr><td>The applicability conditions of the tools referenced in this</td><td>PP is requested to detail on how the individual</td><td>CL4</td></tr></table>	Applicability of the VCS Methodology AM0023:			Applicability criteria	Project activity	Criteria are met?	The methodology is limited to green field projects (i.e., new PO production facilities) wherein PO is the only output.	1. <i>PP is requested to provide PO copy.</i> 2. <i>PP is requested to provide mass balance as from the supplier of the plant / 3rd party report.</i>	CL4	The PO production process must not produce any co-products. There may be by-products produced in the PO production process, due to the selectivity of catalysts.	PP is requested to provide mass balance as from the supplier of the plant / 3 rd party report.	CL4	The PO production process must not create more than 10% (in mass terms) by-product, relative to PO output.	PP is requested to provide mass balance as from the supplier of the plant / 3 rd party report.	CL4	The methodology is applicable only to projects where the project activity is the implementation of the HPPO process and where implementation of the CHPO-chlor-alkali process is identified as the baseline scenario.	As detailed in the VCS-PD, the project activity employs the HPPO technology and it is identified that the baseline scenario of this project activity is Chlorohydrin-Chlor-Alkali process.	OK	The project may be located in any geographic region of the world.	The project activity is located in Thailand, confirmed from the PP's website.	OK	The applicability conditions of the tools referenced in this	PP is requested to detail on how the individual	CL4	CL4 OK
Applicability of the VCS Methodology AM0023:																													
Applicability criteria	Project activity	Criteria are met?																											
The methodology is limited to green field projects (i.e., new PO production facilities) wherein PO is the only output.	1. <i>PP is requested to provide PO copy.</i> 2. <i>PP is requested to provide mass balance as from the supplier of the plant / 3rd party report.</i>	CL4																											
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The PO production process must not create more than 10% (in mass terms) by-product, relative to PO output.	PP is requested to provide mass balance as from the supplier of the plant / 3 rd party report.	CL4																											
The methodology is applicable only to projects where the project activity is the implementation of the HPPO process and where implementation of the CHPO-chlor-alkali process is identified as the baseline scenario.	As detailed in the VCS-PD, the project activity employs the HPPO technology and it is identified that the baseline scenario of this project activity is Chlorohydrin-Chlor-Alkali process.	OK																											
The project may be located in any geographic region of the world.	The project activity is located in Thailand, confirmed from the PP's website.	OK																											
The applicability conditions of the tools referenced in this	PP is requested to detail on how the individual	CL4																											

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				methodology also apply. requirements of the tools used are met	
B.1.4	Is the selected baseline one of the baseline(s) described in the methodology and this hence confirms the applicability of the methodology?	/1/, /3/, /4/, /5/, /10/	DR	The project activity employs the HPPO technology and it is identified that the baseline scenario of this project activity is Chlorohydrin-Chlor-Alkali process, confirms the applicability of the methodology, hence accepted.	OK
B.2 Project boundary					
B.2.1	Is the project boundary are clearly defined and in accordance with the applied methodology?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR	Project boundary includes: 1. PO manufacturing plant - from reagents admission to the treatment of by-products and waste from process 2. the project electricity system(s) and Heat/steam generation system that the PO plant is connected to. The project electricity system consists of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. The heat (steam) system is similar, including the heat/steam generating systems that are physically connected to the project activity and that can be displaced without significant constraints. The baseline includes all the above with respect to CHPO manufacturing plant. 1. PP is requested to transparently mention on whether the upstream emissions from reagent(s) production is part of the project boundary. 2. PP is requested to provide a diagram or map of the project boundary, showing clearly the physical locations of the various installations or management activities taking place as part of the project activity / equipments / main stages of	CAR3 OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			<i>PO production process and waste treatment and disposal.</i> <i>PP is requested to detail all the reagents being used and the wastes obtained and its treatment transparently.</i> <i>In the above, PP is requested to detail the mass and energy balance, flow of process, GHG sources, parameters monitored and the location of monitoring equipments.</i> <i>The project boundary is not transparent on the grid to which the project is connected to.</i> <i>The project boundary is not transparent on the source of heat supplied.</i> <i>The project boundary is not transparent on the fuels used.</i>	
B.2.2	What are the project's system boundaries (components and facilities used to mitigate GHGs)?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR Please refer to section B.2.1 above	CAR3 OK
B.2.3	Which sources are identified for the project? Does the identified project boundary cover all possible sources linked to the project activity?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR Baseline emissions: - The emissions associated with production of baseline reagents, Cl₂ and NaOH (Chlor-Alkali). Emissions associated with C₃H₆ has however not been accounted as its usage would be essentially the same as in the project activity - Emissions associated with steam and electricity requirements of the production process Project emissions: - Emissions associated with the production of project reagents - Emissions associated with steam and electricity requirements of the process - Emissions associated with treatment of waste produced by the production process Complete and consistent with the methodology applied,	CAR3 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				however, please refer to section B.2.1 above.	
B.2.4	In case of grid connected electricity project: is the relevant grid correctly identified in accordance with the latest version of tool to calculate emission factor of electricity system and the underlying methodology?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR	The project boundary is not transparent on the grid to which the project is connected to. Please refer to section B.2.1 above	CAR3 OK
B.2.5	Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute by more than 1% to the estimated emission reductions of the project?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR	This would be confirmed on clarification of the queries open in section B.2.1 above.	CAR3 OK
B.3 Identification of the Baseline Scenario					
B.3.1	Which baseline scenarios have been identified? Is the list of the baseline scenarios complete? Does the VCS PD follow the steps to determine the baseline scenario required by the methodology/tool?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR	The following baseline scenarios have been identified: P1: The project activity without carbon revenues; P2: A PO production facility with comparable capacity using a CHPO process (CHPO-lime or CHPO-chlor-alkali processes); P3: A PO production facility with comparable capacity using any other commercially available technology. This meets the requirement of the methodology applied. <i>PP is requested to provide evidence that there is no hindrance for the PP to install CHPO based PO plant for the same capacity.</i> <i>PP is requested to transparently list all the legal requirements pertaining to the implementation of the project plant (with baseline and project technology) in Thailand.</i> <i>VCS-PD is not transparent on the application of the step 0 of the CDM - Tool for the</i>	GL5 OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			<i>demonstration and assessment of additionality.</i> 4. <i>PP is requested to clarify whether the list of PO manufacturing plants as detailed in the VCS PD (at DOW/ in the region/ World) include the plants under implementation and under advanced stages of planning at the time of going ahead with the project and submit evidence.</i> 5. <i>PP is requested to detail on the list of PO manufacturing plants (including their capacity and technology used) under implementation and under advanced stages of planning at the time of submitting the VCS-PD for validation and submit supportive evidence.</i>	
B.3.2	How have the other baseline scenarios been eliminated in order to determine the baseline?	/1/, /3/, /4/, /5/, /10/, /15/- /17/	DR As per the VCS-PD; As the facility is not located close to any lime source, lime based CHPO-lime process has been eliminated. As there is no other commercially available technology, option P3 is eliminated. In this PP is requested to clarify / provide the following: 1. <i>Credible evidence on the statement relating to the availability of lime.</i> 2. <i>PP to clarify on whether all other reagents, except lime are available close to the project, by listing the reagents required, its source and approximate distance from the project site, along with necessary supportive evidences.</i> 3. <i>PP is requested to provide the supportive evidence to demonstrate that there is no commercially available technology to produce (only) PO other than CHPO process.</i>	CL6 OK
B.3.3	What is the baseline scenario? Is the determination of the baseline scenario in accordance with the guidance in the	/1/, /3/, /4/, /5/, /10/, /14/-	DR A plant with the same capacity using the Chlorohydrin process (Chloro-Alkali) is identified as the baseline scenario.	CL4, CL6 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
	methodology?	/17/		PP uses the CDM Tool for the demonstration and assessment of additionality, for further demonstration of barriers and elimination of alternatives. Consistent with the requirement of the methodology. Please refer to section B.1.2 and B.3.3 above	
B.3.4	Has the baseline scenario been determined using conservative assumptions? Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies (E+ / E-), macro-economic trends and political aspirations?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Determination of baseline scenario has been done stepwise as prescribed by the methodology. <i>PP is requested to make it transparent in the VCS-PD on whether the baseline scenario sufficiently take into account relevant national and/or sectoral policies (E+ / E-), macro-economic trends and political aspirations.</i>	GL7 OK
B.4 Additionality					
B.4.1	What tool does the project use to assess additionality? Is this in line with the methodology?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	The project uses CDM Tool for the demonstration and assessment of additionality. Consistent with the requirement of the methodology. However, please refer to section B.1.2 above	GL4 OK
B.4.2	What is the project additionality mainly based on?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	The project additionality is demonstrated stepwise as prescribed by the methodology and uses the CDM Tool for the demonstration and assessment of additionality. The project uses technological barrier for demonstration of additionality. Consistent with methodology applied, hence accepted.	OK
B.4.3 Prior consideration					
B.4.3.1	What is the starting date of the proposed project activity? Is it in accordance with the VCS Standard?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/, /27/	DR	Start date of the project activity is 04-October-2011, being the commissioning date of the new HPPO technology at MTP HPPO Manufacturing Co., Ltd. This meets the start date requirement as defined in the VCS Standard. However, <i>PP is requested to submit credible evidence in support of the start date of the project activity.</i>	GL8 OK
B.4.3.2	Is the project activity a new project activity or existing project?	/1/, /3/, /4/, /5/, /10/, /14-/	DR	This is a green field project at a single site commissioned on 04-October-2011. Please refer to section B.4.3.1 above	GL8 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
		/17/			
B.4.4 Investment analysis					
B.4.4.1	What is the analysis method used to determine whether the proposed project activity is not (a) the most economically or financially attractive; or (b) economically or financially feasible, without the revenue from the sale of certified emission reductions?	/1/, /3/, /4/, /5/, /10/, /14- /17/	DR	The project additionality is demonstrated stepwise as prescribed by the methodology and uses the CDM Tool for the demonstration and assessment of additionality. The project uses technological barrier for demonstration of additionality (Step 3 of section 6 of the methodology; Step 3 of additionality tool), hence investment analysis is not carried out. Consistent with the methodology, hence accepted.	OK
B.4.4.2	What the financial indicator is used?	/1/, /3/, /4/, /5/, /10/, /14- /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.3	If a benchmark is used, is it ensured that it is selected in accordance with the requirements of the EB guidelines and it represents standard returns in the market? Is the benchmark suitable for the type of financial indicator presented? Is it ensured the any risk premiums applied in determining the benchmark reflect the risks associated with the project type or activity?	/1/, /3/, /4/, /5/, /10/, /14- /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.4	Is the investment analysis carried out in accordance with specific guidance from EB? Is the investment analysis complete and accurate? Is the investment analysis provided in a spreadsheet version? Are all the formulas used readable and all relevant cells be viewable and unprotected?	/1/, /3/, /4/, /5/, /10/, /14- /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.5	Cross-check the parameters used in the financial analysis against third party or publicly available sources (all parameters used as input values shall be cross-checked and assessed).	/1/, /3/, /4/, /5/, /10/, /14- /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
B.4.4.6	Are the input values used in the investment analysis valid and applicable at the time of the investment decision taken by the PP?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.7	Where applicable, the PFL has been defined ex-ante according to the applicable EB guideline?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.8	Does the time period of the investment analysis reflect the expected operation of the underlying project activity (technical lifetime)?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.9	Does the fair value of the project activity assets is included at the end of the assessment period as a cash flow in the final year? Is the fair value calculated in accordance with local accounting regulations where available or international best practice?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.10	Does the income tax calculation take depreciation into account? Is the depreciation year in accordance with normal accounting practice in the Host Country	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.11	Sensitivity analysis: have the key parameters contributing to more than 20% of the revenue/costs during operating or implementation been identified?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.11	Sensitivity analysis: is the range of variations is reasonable in the project activity? The main parameters can be changed for the different project category.	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK
B.4.4.12	Have the key parameters been varied to reach the benchmark and the likelihood of this happening been justified to be small?	/1/, /3/, /4/, /5/, /10/, /14-/ /17/	DR	Investment analysis is not applied, please refer to section B.4.4.1 above, hence accepted.	OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
B.4.5 Barrier analysis					
B.4.5.1	Are the barriers identified complimentary to a potential investment analysis?	/1/, /3/, /4/, /5/, /10/, /14- /18/	DR	Project uses Technological barrier to demonstrate additionality, investment analysis has not been carried out. Please refer to section B.4.4.1 above, hence accepted.	OK
B.4.5.2	How were the investment barriers assessed to be real?	/1/, /3/, /4/, /5/, /10/, /14- /18/	DR	Please refer to section B.4.5.2 above	OK
B.4.5.3	How were the technological barriers assessed to be real?	/1/, /3/, /4/, /5/, /10/, /14- /18/	DR	PP primarily quotes two situations, under technological barriers as listed in the additionality tool: 1. Unavailability of this technology in the region. 2. Risk of technology failure. <i>PP is requested to clarify the following:</i> 1. <i>PP is requested to submit credible evidence consistent with the requirements as set out in CDM "Guidelines for objective demonstration and assessment of barriers" against each of the statement made in the section 2.5 of the VCS-PD under barrier analysis.</i> 2. <i>PP is requested to list the technological barriers faced by the PP in the Antwerp (Belgium) HPPO plant and detail on the same were handled and submit evidence.</i> 3. <i>PP is requested to clarify on when the decision to go ahead with the project was taken and submit evidence.</i> 4. <i>VCS-PD mentions "The warm and moist climate of Thailand will also have huge consequences on the long term performance of the plant. Anti-corrosion and proper cooling system is required" this is common for the baseline plant also, PP is requested to clarify.</i> 5. <i>VCS-PD mentions "The scale-up from 300 to 390 kT will require redesigning the whole plant",</i>	GL9 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				<i>this scale-up/ scale-down is common for the baseline plant also, PP is requested to clarify.</i>	
B.4.5.4	How were the other barriers assessed to be real?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	There are no “other” barriers discussed.	OK
B.4.5.5	Barriers due to prevailing practice (First of its kind): does the project apply measures currently covered in the framework (fuel and feedstock switch, switch of technology with or without change of energy source, methane destruction, methane formation avoidance)?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	The project activity does not use the barrier due to prevailing practice.	OK
B.4.5.6	Barriers due to prevailing practice (First of its kind): do the technologies deliver the same output and differ by at least of energy source/fuel, feed stock, size of installation?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	Please refer to section B.4.5.5 above.	OK
B.4.5.7	Barriers due to prevailing practice (First of its kind): does the applicable geographical area is in compliance with the definition as per the EB guideline?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	Please refer to section B.4.5.5 above.	OK
B.4.5.8	Is the project activity prevented by the identified barriers and at least one of the possible alternatives to the project activity is feasible under the same circumstances?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	Please refer to section B.4.5.3 above	CL9 OK
B.4.5.9	How the VCS can alleviate the identified barriers?	/1/, /3/, /4/, /5/, /10/, /14/- /18/	DR	<i>PP is requested to detail transparently in the VCS PD on how VCS alleviates the identified barriers using the “Guidelines for objective demonstration and assessment of barriers”.</i>	CL10 OK
B.4.6 Common practice analysis					
B.4.6.1	Does the project apply measures currently covered in the framework (fuel and feedstock switch, switch of technology with or without change of energy source, methane destruction, methane formation avoidance)?	/1/, /3/, /4/, /5/, /10/, /14/- /19/	DR	<i>PP is requested to clarify on the use of step 0 of the additionality tool, incase step 0 is not applied, PP is requested to transparently document stepwise application of the CDM “Guidelines on common practice”</i>	CAR4 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
B.4.6.2	Do the technologies deliver the same output and differ by at least of energy source/fuel, feed stock, size of installation, investment climate in the date of the investment decision, other features?	/1/, /3/, /4/, /5/, /10/, /14- /19/	DR	Please refer to section B.4.6.1 above	CAR4 OK
B.4.6.3	Does the applicable geographical area is in compliance with the definition as per the EB guideline?	/1/, /3/, /4/, /5/, /10/, /14- /19/	DR	Please refer to section B.4.6.1 above	CAR4 OK
B.4.6.4	How many similar non-CDM-projects exist in the region within the scope?	/1/, /3/, /4/, /5/, /10/, /14- /19/	DR	Please refer to section B.4.6.1 above	CAR4 OK
B.4.6.5	What is the data source(s) used for the common practice analysis?	/1/, /3/, /4/, /5/, /10/, /14- /19/	DR	Please refer to section B.4.6.1 above	CAR4 OK
B.4.7 Conclusion					
B.4.7.1	What is the conclusion with regard to the additionality of the project activity?	/1/, /3/, /4/, /5/, /10/, /14- /19/	DR	For want of corrections and clarifications as detailed above in section B.4 of this report, this will be concluded in the final validation report.	CAR4, CL4 CL8, CL9, CL10 OK
B.5 Algorithms and/or formulae used to determine emission reductions					
B.5.1 Baseline emissions					
B.5.1.1	Are the steps and equations applied to calculate the baseline emissions in compliance with the requirements of selected baseline and monitoring methodology?	1/, /3/, /4/, /5/, /10/, /14-/19/	DR	Baseline emissions (BE_y) = $BE_{Upstream,y}$ + $BE_{Process,y}$. Where: $BE_{Upstream,y}$ is the Emissions associated with the baseline reagents required for the production of PO in year y (tCO_2) $BE_{Process,y}$ is the Emissions due to energy usage (heat and electricity) for transforming the baseline reagents into the final product (PO) and also for waste and by-product treatment in year y (tCO_2) The up-stream emissions are due to production of	OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			various reagents used in the process. The reagents used in the baseline (CHPO-Chlor-Alkali process) are C₃H₆, Cl₂ and NaOH. The emission associated with C₃H₆ is not accounted as its usage would be same as in the project activity. The emission associated with Chlor-Alkali production is accounted. BE_{Upstream, y} is calculated as BE_{Upstream, y} = be_{Chlor-Alkali, y} x PO_y Where: be_{Chlor-Alkali, y} is the Quantity of CO₂ that would be emitted from Chlor-Alkali production per unit of PO in year y (tons) PO_y is the Quantity of PO produced in year y (tons) Reagents used in baseline process are Chloro-alkali (Chlorine and Sodium Hydroxide). The CO₂ emissions associated with Chlor-Alkali production are calculated as follows: be_{Chlor-Alkali, y} is calculated to be be_{Chlor-Alkali, y} = (71/58) x ec_{Chlor-Alkali, y} x EF_{EL, y}. Where: ec_{Chlor-Alkali, y} is the Energy consumption per ton of Cl₂ production (MWh/tCl₂). EF_{EL, y} is the Emission factor for electricity generation in year y (tCO₂/MWh). 71/58 is the Ratio between the molecular weights of Cl₂ and C₃H₆O (mass units/mass units) Emissions due to energy usage (BE_{Process, y}) heat (BE_{heat, y}), electricity (BE_{Elec, y}) for transforming the baseline reagents into the final product (PO) and treatment of waste generated out of the process (BE_{Waste, y}) is calculated as	

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			under: $BE_{Process,y} = BE_{heat,y} + BE_{Elec,y} + BE_{Waste,y}$ Where $BE_{heat,y}$ is calculated to be $BE_{heat,y} = SSC_{CHPO} \times PO_y \times EF_{Steam,y}$ Where: $BE_{Heat,y}$ is the Emissions due to thermal energy (heat/steam) for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO_2) SSC_{CHPO} is the Specific thermal energy consumption ratio in the PO production through CHPO process (TJ/ton of PO) $EF_{Steam,y}$ is the Emission factor for thermal energy generation in year y (tCO_2/TJ) is calculated as: $EF_{Steam,y} = EF_{CO2,i,y} / \eta_{Boiler,y}$ Where: $EF_{CO2,i,y}$ is the Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/TJ). $\eta_{Boiler,y}$ is the Efficiency of the steam generating system . $BE_{elec,y}$ is the Emissions due to electrical energy for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO_2) calculated as: $BE_{elec,y} = SEC_{CHPO} \times PO_y \times EF_{El,y}$ Where: SEC_{CHPO} is the Specific electrical energy consumption ratio in the PO production through CHPO process (MWh/ton of PO). $EF_{El,y}$ is the Emission factor for electricity generation in year y (tCO_2/MWh).	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				BE_{Waste,y} is the Emissions due to treatment of waste products in year y (tCO₂), calculated as: $BE_{Waste,y} = (44/12) \times (CA_{Waste, Baseline}) + FC_{i,Baseline,} \times COEF_{,i}$ Where CA_{Waste, Baseline} is the carbon amount in the waste stream derived from the carbon amount in the Propylene feed, PO and by-products in the baseline (tons). The carbon amount in the waste stream and fuel combusted in the incinerator is presented in terms of PO output. Values are to be justified at project level. (44/12) is the ratio between the molecular weights of CO₂ and Carbon (mass units/mass units) FC_{i,Baseline} is the Quantity of fuel type i combusted in the incinerator in the baseline (mass or volume unit/year). COEF_{,i} is the CO₂ emission coefficient of fuel type i (tCO₂/mass or volume unit). Baseline emissions linked to waste and by-products are neglected. The steps and the approach adopted by the project activity is consistent with the methodology applied, hence accepted.	
B.5.1.2	Have conservative assumptions been used when calculating the baseline emissions and are the uncertainty estimates properly addressed? Are all the values used in the VCS PD considered reasonable in the context of the proposed project activity?	1/, /3/, /4/, /5/, /10/, /14/-/25/	DR/ CC	<i>PO_y is the Quantity of PO produced in year y (tons), value applied 337,206 tons as per the VCS-PD, the same is not consistent with the ER sheet (430,000 tons), PP is requested to clarify and submit evidence.</i> <i>ec_{Chlor-Alkali, y} is the Energy consumption per ton of Cl₂ production (MWh/tCl₂), value applied 2.2, sourced from Multilateral Investment Guarantee Agency Environmental Guidelines for Chlor-Alkali Industry, a credible independent</i>	~~CL11~~ OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			third party, however the source for the same is not transparent in the ER sheet. $EF_{EL,y}$ is the Emission factor for electricity generation in year y (tCO_2/MWh), calculated according to the 'Tool to calculate the emission factor for an electricity system' value applied 0.5113, source is not consistent in the ER sheet. PP is requested to submit the stepwise calculation of emission factor as per the tool applied and submit a spreadsheet detailing the calculations and values used. The source of base data is mentioned to be annual report of power plant in section 4.2 of the VCS-PD; PP is requested to clarify on how this is consistent with the requirement of the applied CDM Tool to calculate the emission factor for an electricity system. SSC_{CHPO} is the Specific thermal energy consumption ratio in the PO production through CHPO process (TJ/ton of PO), value applied is 0.009795, sourced from Nexant report on HPPO, however the page numbers quoted in the VCS-PD and the ER sheet are not consistent. The value applied is not directly available in the report; PP is requested to make the calculations made transparently available in the VCS-PD using the values available in the source document. $EF_{CO2,i,y}$ is the Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/TJ), value applied 56.1, IPCC default value for natural gas, PP is requested to clarify the logic behind choosing natural gas as fuel, why default value (option d) has been selected and also on why the lower limit (since baseline) value of the uncertainty at a 95% confidence interval is not taken as required by the tool applied. Further the value applied is not consistent with the value used in ER sheet. $\eta_{Boiler,y}$ is the Efficiency of the steam generating system, value applied is 100%, PP is requested to make it transparent in the VCS-PD on how it is consistent with the Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				efficiency of the boiler. SEC_{CHPO} is the Specific electrical energy consumption ratio in the PO production through CHPO process (MWh/ton of PO), value applied is 0.100, sourced from Nexant report on HPPO, however the page numbers quoted in the VCS-PD and the ER sheet are not consistent. The value applied is not directly available in the report; PP is requested to make the calculations made transparently available in the VCS-PD using the values available in the source document. $COEF_i$ is the CO₂ emission coefficient of fuel type i (tCO₂/mass or volume unit). Value applied 2.693. sourced as per Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion, however the calculation is not transparently available either in VCS-PD and ER sheet.	
B.5.1.3	Baseline Emissions estimated	/1/, /3/, /4/, /5/, /10/, /14/- /25/	DR/ CC	Baseline emissions estimated is 614,109 tCO₂e annual average and 6,141,090 tCO₂e over the 10 year crediting period. Please refer to section B.5.1.2 above	GL11 OK
B.5.2 Project emissions					
B.5.2.1	Are the steps and equations applied to calculate the project emissions in compliance with the requirements of selected baseline and monitoring methodology? Are all the values used in the VCS PD considered reasonable in the context of the proposed project activity?	/1/, /3/, /4/, /5/, /10/, /14/- /25/	DR/ CC	Project emissions $PE_{y} = PE_{Upstream,y} + PE_{Process,y}$. Where $PE_{Upstream,y}$ is the Emissions associated with the project reagents for the production of PO in year y (tCO₂) $PE_{Process,y}$ is the Emissions due to energy usage (heat, electricity etc.) for transforming the project reagents into the final product (PO) and also for waste treatment in year y (tCO₂) The reagents used in the project process are Propylene, Hydrogen Peroxide and solvent. Propylene is common reagent in both baseline and project scenarios, hence	OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			not considered, consistent with the methodology. Hence $PE_{Upstream,y}$ is calculated as $PE_{Upstream,y} = PE_{Upstream,H_2O_2,y} + PE_{Upstream, Solvent,y}$ $PE_{Upstream,H_2O_2,y} = (34/58) \times pe_{HP} \times PO_y$ Where (34/58) is the Ratio between the molecular weights of H_2O_2 and C_3H_6O (mass units/mass units) pe_{HP} is the Quantity of CO_2 that would be emitted per ton of H_2O_2 (tCO_2/tH_2O_2). PO_y is the Quantity of PO produced in year y (tons) $PE_{Upstream, Solvent,y}$ is the emissions associated with the use (make-up) of solvent is calculated as: $PE_{Upstream, Solvent,y} = pe_{Sol} \times sol_y \times PO_y$ Where pe_{Sol} is the Quantity of CO_2 that would be emitted per ton of Solvent ($tCO_2/ ton of Solvent$) sol_y is the Quantity of solvent (tons) required per ton of PO, sourced from the design details of the project and for ex-post calculation instead of specific (sol_y) the total solvent consumption ($Sol_{,y}$) is a monitoring parameter. PO_y is the Quantity of PO produced in year y (tons) The process emissions arise due to energy usage (heat ($PE_{heat,y}$), electricity ($PE_{Elec,y}$)) for transforming the reagents into the final product, by-products and also for waste treatment ($PE_{Waste,y}$), hence calculated as:	

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			$PE_{Process,y} = PE_{heat,y} + PE_{Elec,y} + PE_{Waste,y}$ $PE_{heat,y}$ is calculated to be $PE_{heat,y} = SSC_{HPPO} \times PO_y \times EF_{Steam,y}$ Where: SSC_{HPPO} is the Specific thermal energy consumption ratio in the PO production through HPPO process (TJ/ton of PO). $EF_{Steam,y}$ is the Emission factor for thermal energy generation in year y (tCO₂/TJ). $PE_{elec,y}$ is calculated to be $PE_{elec,y} = SEC_{HPPO} \times PO_y \times EF_{El,y}$ Where: SEC_{HPPO} is the Specific electrical energy consumption ratio in the PO production through HPPO process (MWh/tonne of PO). $EF_{El,y}$ is the Emission factor for electricity generation in year y (tCO₂/MWh). $PE_{Waste,y}$ is calculated to be $PE_{Waste,y} = (44/12) \times (CA_{Waste,y}) + FC_{i,y} \times COEF_{i,y}$	

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			Where $CA_{Waste,y}$ is the Carbon amount in the waste stream derived from the carbon amount in the Propylene feed, Solvent, PO and by-products during year y (tons). Calculation of $CA_{Waste,y}$ is detailed below. (44/12) is the ratio between the molecular weights of CO₂ and Carbon (mass units/mass units) $FC_{i,y}$ is the Quantity of fuel type i combusted in the incinerator during the year y (mass or volume unit/year). $COEF_i$ is the CO₂ emission coefficient of fuel type i (tCO₂/mass or volume unit). The carbon amount in the waste stream is calculated as a difference between the carbon amount (CA) in the feed and the carbon amount in product and byproduct. For validation the PP considers the solvent to be methanol, which gives the by-product monopropyleneglycol (C₃H₈O₂), hence calculated as: $CA_{Waste,y} = (36/42) \times Q_{Propylene,y} + (12/32) \times Sol_y - (36/58) \times PO_y - (36/76) \times Q_{Byproduct,y}$ (36/42) is the Carbon fraction in propylene (mass units/mass units) (12/32) is the Carbon fraction in methanol (mass units/mass units) (36/58) is the Carbon fraction in Propylene oxide(mass units/mass units) (36/76) is the Carbon fraction in monopropyleneglycol (mass units/mass units) $Q_{Propylene,y}$ is the Quantity of propylene used in year y	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				(tons) Sol_y is the Quantity of make-up methanol used in year y (tons) PO_y is the Quantity of PO produced in year y (tons) $Q_{Byproduct, y}$ is the Quantity of monopropyleneglycol produced in year y (tons) This is consistent with the methodology applied, hence accepted.	
B.5.2.2	Have conservative assumptions been used when calculating the project emissions and are the uncertainty estimates properly addressed?	/1/, /3/, /4/, /5/, /10/, /14/- /25/	DR / CC	pe_{HP} is the Quantity of CO₂ that would be emitted per ton of H₂O₂ (tCO₂/ tH₂O₂), value applied 0.533, the weblink given as reference is not active, PP is requested to update the same. PO_y is the Quantity of PO produced in year y (tons), this is the same as discussed in baseline emissions section above. pe_{Sol} is the Quantity of CO₂ that would be emitted per ton of Solvent (tCO₂/ ton of Solvent), the VCS-PD is not transparent on the value used . 5.285 is the value applied in ER sheet, sourced from Table 3.12, Chapter 3: Chemical Industry Emissions, IPCC 2006 report, the highest value, hence conservative, however PP is requested to clarify the same in the VCS-PD. sol_y is the Quantity of solvent (tons) required per ton of PO, value applied is 0.0139, source is not transparently available in the VCS-PD, ER sheet mentions the source to be Nexant report for HPPO, cross checked with Table 4.3 of the report and found consistent, however, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. For ex-post calculation instead of specific (sol_y) the total solvent consumption ($Sol_{,y}$) is a monitoring parameter.	~~CL11,~~ CL12 OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			SSC_{HPPO} is the Specific thermal energy consumption ratio in the PO production through HPPO process (TJ/ton of PO). Value applied is not transparently available in the VCS-PD, ER sheet mentions the value to be 0.009217 and the source to be Nexant report for HPPO, the value is not directly available in the page mentioned. Further, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. $EF_{Steam,y}$ is the Emission factor for thermal energy generation in year y (tCO₂/TJ). This is the same as discussed in baseline emissions section above. SEC_{HPPO} is the Specific electrical energy consumption ratio in the PO production through HPPO process (MWh/tonne of PO). Value applied is not transparently available in the VCS-PD, ER sheet mentions the value to be 0.108 and the source to be Nexant report for HPPO, the value is not directly available in the page mentioned. Further, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. $EF_{El,y}$ is the Emission factor for electricity generation in year y (tCO₂/MWh). This is the same as discussed in baseline emissions section above. $FC_{i,y}$ is the Quantity of fuel type i combusted in the incinerator during the year y (mass or volume unit/year). This has been excluded; PP is requested to justify the same with credible evidence on how this is conservative as it is part of project emissions. $COEF_i$ is the CO₂ emission coefficient of fuel type i	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				(tCO₂/mass or volume unit). This is the same as discussed in baseline emissions section above. <i>Q_{Propylene, y} is the Quantity of propylene used in year y (tons), value applied 337,206 sourced from Nexant report, this value is not directly available in the report and calculated based on specific consumption, PP is requested to make this calculation transparent in the VCS-PD. The ER value applied in the ER sheet is consistent with the source document.</i> <i>Q_{Byproduct, y} is the Quantity of monopropyleneglycol produced in year y (tons), this has been excluded for simplification, conservative, however this is not transparently available in the VCS-PD.</i> Please refer to section B.5.1.2 above.	
B.5.2.3	Project emissions estimated	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR / CC	Project emissions estimated is 270,910 tCO₂e annual average and 2,709,100 tCO₂e over the 10 year crediting period. Please refer to section B.5.2.2 above	CL11, CL12 OK
B.5.3 Leakage					
B.5.3.1	Are the steps and equations applied to calculate the leakage in compliance with the requirements of selected baseline and monitoring methodology? Are all the values used in the VCS PD considered reasonable in the context of the proposed project activity?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR / CC	Leakage is not considered under the applied methodology	OK
B.5.3.2	Have conservative assumptions been used when calculating the leakage and are the uncertainty estimates properly addressed?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR / CC	Please refer to section B.5.3.1 above	OK
B.5.3.3	Leakage estimated	/1/, /3/, /4/, /5/	DR / CC	Please refer to section B.5.3.1 above	OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
		/10/, /14- /25/			
B.5.4 Emission reductions					
B.5.4.1	Has the methodology been correctly applied to calculate the emission reductions and can this be replicated by the data provided in the VCS PD and supporting files to be submitted for registration?	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR / CC	The approach adopted is consistent with the methodology applied, however please refer to sections B.5.1, B.5.2 and B.5.3 above	~~CL11,~~ CL12 OK
B.5.4.2	Are all the assumptions and data used by the project participants listed in the VCS PD including their references and sources?	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR / CC	Please refer to sections B.5.1, B.5.2 and B.5.3 above	~~CL11,~~ CL12 OK
B.5.4.3	Is all the documentation used by the project participants as the basis for assumptions and source of data quoted and interpreted in the VCS PD?	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR / CC	Please refer to sections B.5.1, B.5.2 and B.5.3 above	~~CL11,~~ CL12 OK
B.5.4.4	Emission Reductions estimated	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR / CC	Emission reductions estimated is 343,199 tCO ₂ e annual average and 3,431,990 tCO ₂ e over the 10 year crediting period. However, please refer to sections B.5.1, B.5.2 and B.5.3 above	~~CL11,~~ CL12 OK
B.6 Monitoring plan					
B.6.1 Parameters ex-ante					
B.6.1.1	Does the monitoring plan contain the list of all parameters required by the approved methodology and by the applicable methodological tool?	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR / CC	The following parameters have been included as parameters available a Validation: <i>ec_{Chlor-Alkali, y}</i> , the Energy consumption per ton of Cl ₂ production in year y (MWh/tCl ₂). <i>SSC_{CHPO}</i> , the Specific thermal energy consumption ratio in PO production through the CHPO-chlor-alkali process (TJ/ton of PO). <i>SEC_{CHPO}</i> the specific electrical energy consumption ratio in PO production through the CHPO-chlor-alkali process (MWh/ton of PO). <i>pe_{HP}</i> the Quantity of CO ₂ emitted per ton of H ₂ O ₂ . (tCO ₂ /tH ₂ O ₂).	~~CL13~~ OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			pe_{Sol} the Quantity of CO₂ emitted per ton of methanol (tCO₂/ton of methanol solvent). The following have been excluded for simplification, conservative and consistent with the applied methodology, hence accepted: $ca_{Waste, Baseline}$ the Carbon amount in the waste stream combusted in the incinerator in the baseline per tonne of PO (tC/tonne of PO). $fci_{Baseline}$ the Quantity of fuel type i combusted in the incinerator in the baseline per tonne of PO (Mass or volume unit in baseline per tonne of PO). <i>PP is requested to transparently document the parameters available at the time of validation as required by the tools applied and detail on how they have been complied.</i>	
B.6.1.2	How were the parameters available at validation verified?	/1/, /3/, /4/, /5/, /10/, /14/-/25/	DR/CC $ec_{Chlor-Alkali, y}$ is the Energy consumption per ton of Cl₂ production (MWh/tCl₂), value applied 2.2, sourced from Multilateral Investment Guarantee Agency Environmental Guidelines for Chlor-Alkali Industry, a credible independent third party, however the source for the same is not transparent in the ER sheet. <i>SSC_{CHPO} is the Specific thermal energy consumption ratio in the PO production through CHPO process (TJ/ton of PO), ex-post this is calculated from the actual steam consumption, however the VCS-PD is not transparent on the requirement of the methodology on accounting the enthalpy of the feed-water, the boiler blow-down and any condensate return.</i> SEC_{CHPO} is the Specific electrical energy consumption ratio in the PO production through CHPO process (MWh/ton of PO), value applied is 0.100, sourced from	CL11, CL12, CL13 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion				
				Nexant report on HPPO, however the page numbers quoted in the VCS-PD and the ER sheet are not consistent. The value applied is not directly available in the report; PP is requested to make the calculations made transparently available in the VCS-PD using the values available in the source document. pe_{HP} is the Quantity of CO₂ that would be emitted per ton of H₂O₂ (tCO₂/ tH₂O₂), value applied 0.533, the weblink given as reference is not active, PP is requested to update the same. pe_{Sol} is the Quantity of CO₂ that would be emitted per ton of Solvent (tCO₂/ ton of Solvent), the VCS-PD is not transparent on the value used . 5.285 is the value applied in ER sheet, sourced from Table 3.12, Chapter 3: Chemical Industry Emissions, IPCC 2006 report, the highest value, hence conservative, however PP is requested to clarify the same in the VCS-PD. Please refer to section B.5.1.2, B.5.2.2 and B.6.1.1 above.					
B.6.1.3	Which default data have been selected and applied?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	No default value has been used in the parameters available at validation; however please refer to section B.6.1.1 above.	CL13 OK				
B.6.1.4	Are all the values used in the VCS PD considered reasonable in the context of the proposed project activity?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	Please refer to section B.6.1.2 above	CL13 OK				
B.6.2 Parameters ex-post									
B.6.2.1	Does the monitoring plan described in the VCS PD comply with the requirements of the methodology and the applicable methodological tool?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	PP is requested to transparently document the parameters to be monitored ex-post as required by the tools applied and detail on how they have been complied.	CL14 OK				
B.6.2.2	Does the monitoring plan contain all necessary parameters and are they clearly described?	/1/, /3/, /4/, /5/, /10/, /14-/	DR/ CC	<table><tr><td>Parameter</td><td>PO_y</td></tr><tr><td>Description</td><td>Final quantity of PO produced in year y.</td></tr></table>	Parameter	PO _y	Description	Final quantity of PO produced in year y.	CL11, OK CL12,
Parameter	PO _y								
Description	Final quantity of PO produced in year y.								

Checklist Question		Reference	MoV ¹	Comments		Conclusion									
		/25/		<table><tr><td>Unit</td><td>Tons</td></tr><tr><td>Source</td><td>Plant records.</td></tr><tr><td>Comment</td><td>Consistent with Methodology</td></tr></table>	Unit	Tons	Source	Plant records.	Comment	Consistent with Methodology	CL14 OK				
Unit	Tons														
Source	Plant records.														
Comment	Consistent with Methodology														
		<table><tr><td>Parameter</td><td>Sol_y</td></tr><tr><td>Description</td><td>Quantity of make-up methanol solvent used in year y.</td></tr><tr><td>Unit</td><td>Tons</td></tr><tr><td>Source</td><td>Plant records.</td></tr><tr><td>Comment</td><td>Consistent with Methodology</td></tr><tr><td>Comment</td><td>Please refer to section B.5.1.2</td></tr></table>	Parameter	Sol_y	Description	Quantity of make-up methanol solvent used in year y.	Unit	Tons	Source	Plant records.		Comment	Consistent with Methodology	Comment	Please refer to section B.5.1.2
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		<table><tr><td>Parameter</td><td>$EF_{EL,y}$</td></tr><tr><td>Description</td><td>Emission factor for electricity generation in year y.</td></tr><tr><td>Unit</td><td>tCO₂/MWh</td></tr><tr><td>Source</td><td>Calculated as per CDM Tool to calculate the emission factor for an electricity system.</td></tr><tr><td>Comment</td><td>Please refer to section B.5.1.2</td></tr></table>	Parameter	$EF_{EL,y}$	Description	Emission factor for electricity generation in year y.	Unit	tCO ₂ /MWh	Source	Calculated as per CDM Tool to calculate the emission factor for an electricity system.		Comment	Please refer to section B.5.1.2		
Parameter	$EF_{EL,y}$														
Description	Emission factor for electricity generation in year y.														
Unit	tCO ₂ /MWh														
Source	Calculated as per CDM Tool to calculate the emission factor for an electricity system.														
Comment	Please refer to section B.5.1.2														
		<table><tr><td>Parameter</td><td>$EF_{CO_2, i, y}$</td></tr><tr><td>Description</td><td>Weighted average CO₂ emission factor of fuel type i in year y.</td></tr><tr><td>Unit</td><td>tCO₂/TJ</td></tr><tr><td>Source</td><td>IPCC default value</td></tr><tr><td>Comment</td><td>Please refer to section B.5.1.2</td></tr></table>	Parameter	$EF_{CO_2, i, y}$	Description	Weighted average CO ₂ emission factor of fuel type i in year y.	Unit	tCO ₂ /TJ	Source	IPCC default value		Comment	Please refer to section B.5.1.2		
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		<table><tr><td>Parameter</td><td>$\eta_{Boiler,y}$</td></tr><tr><td>Description</td><td>Efficiency of the steam generating system in year y.</td></tr><tr><td>Unit</td><td>%</td></tr><tr><td>Source</td><td>Default value (100%)</td></tr><tr><td>Comment</td><td>Please refer to section B.5.1.2</td></tr></table>	Parameter	$\eta_{Boiler,y}$	Description	Efficiency of the steam generating system in year y.	Unit	%	Source	Default value (100%)		Comment	Please refer to section B.5.1.2		
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Source	Default value (100%)														
Comment	Please refer to section B.5.1.2														
		<table><tr><td>Parameter</td><td>$SC_{HPPO, y}$</td></tr></table>	Parameter	$SC_{HPPO, y}$											
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Checklist Question	Reference	MoV ¹	Comments	Conclusion										
			<table><tr><td>Description</td><td>Thermal energy consumption in PO production through the HPPO process in year y.</td></tr><tr><td>Unit</td><td>TJ</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology</td></tr></table>	Description	Thermal energy consumption in PO production through the HPPO process in year y.	Unit	TJ	Source	Plant records	Comment	Consistent with the methodology			
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			<table><tr><td>Parameter</td><td>$EC_{HPPO,y}$</td></tr><tr><td>Description</td><td>Electrical energy consumption in PO production through the HPPO process in year y.</td></tr><tr><td>Unit</td><td>MWh</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology</td></tr></table>	Parameter	$EC_{HPPO,y}$	Description	Electrical energy consumption in PO production through the HPPO process in year y.	Unit	MWh	Source	Plant records	Comment	Consistent with the methodology	
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			<table><tr><td>Parameter</td><td>$Q_{Propylene,y}$</td></tr><tr><td>Description</td><td>Quantity of propylene used in year y.</td></tr><tr><td>Unit</td><td>Tons</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology</td></tr></table>	Parameter	$Q_{Propylene,y}$	Description	Quantity of propylene used in year y.	Unit	Tons	Source	Plant records	Comment	Consistent with the methodology	
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Parameter	$FC_{i,y}$													
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Checklist Question		Reference	MoV ¹	Comments	Conclusion																																						
				<table><tr><td>Description</td><td>CO₂ emission coefficient of Natural gas</td></tr><tr><td>Unit</td><td>tCO₂/t of Natural gas</td></tr><tr><td>Source</td><td>IPCC</td></tr><tr><td>Comment</td><td>Please refer to section B.5.1.2</td></tr></table> The following parameters not available in the Methodology, but required to calculate the parameter $SC_{HPPO,y}$ are also monitored: <table><tr><td>Parameter</td><td>$Temp_{steam,HPPO,y}$</td></tr><tr><td>Description</td><td>Temperature of steam from captive thermal plant for HPPO process.</td></tr><tr><td>Unit</td><td>°C</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology.</td></tr></table> <table><tr><td>Parameter</td><td>$Q_{steam,HPPO,y}$</td></tr><tr><td>Description</td><td>Quantity of steam from captive thermal plant for HPPO process</td></tr><tr><td>Unit</td><td>Tons</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology.</td></tr></table> <table><tr><td>Parameter</td><td>$P_{EC,HPPO,y}$</td></tr><tr><td>Description</td><td>Pressure of steam from captive thermal plant for HPPO process</td></tr><tr><td>Unit</td><td>Bar</td></tr><tr><td>Source</td><td>Plant records</td></tr><tr><td>Comment</td><td>Consistent with the methodology.</td></tr></table> Please refer to section B.6.2.1 above	Description	CO ₂ emission coefficient of Natural gas	Unit	tCO ₂ /t of Natural gas	Source	IPCC	Comment	Please refer to section B.5.1.2	Parameter	$Temp_{steam,HPPO,y}$	Description	Temperature of steam from captive thermal plant for HPPO process.	Unit	°C	Source	Plant records	Comment	Consistent with the methodology.	Parameter	$Q_{steam,HPPO,y}$	Description	Quantity of steam from captive thermal plant for HPPO process	Unit	Tons	Source	Plant records	Comment	Consistent with the methodology.	Parameter	$P_{EC,HPPO,y}$	Description	Pressure of steam from captive thermal plant for HPPO process	Unit	Bar	Source	Plant records	Comment	Consistent with the methodology.	
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B.6.2.3	Is the measurement equipment described? Is the accuracy of the measurement equipment addressed and deemed appropriate? Are the requirements for maintenance and calibration of measurement equipment described and	/1/, /3/, /4/, /5/, /10/, /14- /25/	DR/ CC	<table><tr><td>Parameter</td><td>PO_y</td></tr><tr><td>Description</td><td>Final quantity of PO produced in year y.</td></tr></table>	Parameter	PO_y	Description	Final quantity of PO produced in year y.	CL11, CL12, CL13, CL14,																																		
Parameter	PO_y																																										
Description	Final quantity of PO produced in year y.																																										

Checklist Question		Reference	MoV ¹	Comments		Conclusion
	deemed appropriate?			Measurement equipment	<i>PO quantity (tons) is measured using volume flowmeter; PP is requested to clarify on how the volume to weight conversion is done.</i>	GL15 OK
				Accuracy	Accuracy requirement is not detailed in the methodology, PP uses Meter series: FT431118	
				Calibration	Meters will be calibrated regularly according to manufacturer's guidelines. Cross-checking with production stock inventory.	
				Parameter	Sol_y	
				Description	Quantity of make-up methanol solvent used in year y.	
				Measurement equipment	<i>Sol_y – Methanol quantity (tons) is measured using volume flowmeter; PP is requested to clarify on how the volume to weight conversion is done.</i>	
				Accuracy	<i>Accuracy of the volume flow meter used for measurement of solvent quantity is not transparent in the VCS-PD</i>	
				Calibration	Meters will be calibrated regularly according to manufacturer's guidelines. Cross-checking with production stock inventory.	
				Parameter	$EF_{EL,y}$	
				Description	Emission factor for electricity generation in year y.	
				Measurement equipment	Calculated	
				Accuracy	Calculated	
				Calibration	Calculated	

Checklist Question		Reference	MoV ¹	Comments		Conclusion
				Parameter	$EF_{CO_2, i, y}$	
				Description	Weighted average CO ₂ emission factor of fuel type i in year y.	
				Measurement equipment	IPCC default value	
				Accuracy	IPCC default value	
				Calibration	IPCC default value	
				Parameter	$\eta_{Boiler, y}$	
				Description	Efficiency of the steam generating system in year y.	
				Measurement equipment	Default value (100%)	
				Accuracy	Default value (100%)	
				Calibration	Default value (100%)	
				Parameter	$SC_{HPPO, y}$	
				Description	Thermal energy consumption in PO production through the HPPO process in year y.	
				Measurement equipment	Please refer to section B.6.1.2 above	
				Accuracy	Calculated	
				Calibration	Calculated	
				Parameter	$EC_{HPPO, y}$	
				Description	Electrical energy consumption in PO production through the HPPO process in year y.	
				Measurement equipment	Electricity meters	
				Accuracy	Not given by the methodology, PP uses Meter series: X14000334N, X14000335N, X14000336N.	

Checklist Question		Reference	MoV ¹	Comments		Conclusion	
					X14000337N		
				Calibration	Will be done as per manufacturer's guidelines.		
				Parameter	$Q_{Propylene,y}$		
				Description	Quantity of propylene used in year y.		
				Measurement equipment	VCS-PD is not transparent on the monitoring equipment used for the measurement of quantity of propylene used in the project activity.		
				Accuracy	VCS-PD is not transparent on the accuracy of the equipment used for the measurement of quantity of propylene used in the project activity.		
				Calibration	As per manufacturer's guidelines, cross checked with stock inventory.		
				Parameter	$Q_{By-product,y}$		
				Description	Quantity of by-product produced in year y.		
				Measurement equipment	VCS-PD is not transparent on the monitoring equipment used for the measurement of quantity of by-product in the project activity.		
				Accuracy	VCS-PD is not transparent on the accuracy of the equipment used for the measurement of quantity of by-product in the project activity.		
				Calibration	As per manufacturer's guidelines, cross checked with stock inventory.		
				Parameter	$FC_{i,y}$		
				Description	Quantity of NG combusted in the incinerator in year y.		
				Measurement equipment	Please refer to section 5.2.2 above		

Checklist Question		Reference	MoV ¹	Comments		Conclusion
				Accuracy	Please refer to section 5.2.2 above	
				Calibration	Please refer to section 5.2.2 above	
				Parameter	$COEF_{i,y}$	
				Description	CO ₂ emission coefficient of Natural gas	
				Measurement equipment	Please refer to section B.5.1.2 above.	
				Accuracy	Please refer to section B.5.1.2 above.	
				Calibration	Please refer to section B.5.1.2 above.	
				Parameter	$Temp_{steam,HPPO,y}$	
				Description	Temperature of steam from captive thermal plant for HPPO process.	
				Measurement equipment	Temperature meter	
				Accuracy	Meter series: TT950001	
				Calibration	As per manufacturer's guidelines.	
				Parameter	$Q_{steam,HPPO,y}$	
				Description	Quantity of steam from captive thermal plant for HPPO process	
				Measurement equipment	Flow meter	
				Accuracy	Meter series: FT950001	
				Calibration	As per manufacturer's guidelines.	
Parameter	$P_{EC,HPPO,y}$					
Description	Pressure of steam from captive thermal plant for HPPO process					
Measurement equipment	Pressure meter					
Accuracy	Meter series: PT950001					

Checklist Question		Reference	MoV ¹	Comments		Conclusion																											
				<table><tr><td>Calibration</td><td>As per manufacturer's guidelines.</td></tr></table> <i>PP is requested to detail on the responsible person/entity who will perform the calibration and the accreditation requirement of the calibration agency.</i> <i>PP is requested to submit the specification sheets of meters used for measurement parameters monitored.</i> Please refer to section B.6.2.1 above	Calibration	As per manufacturer's guidelines.																											
Calibration	As per manufacturer's guidelines.																																
B.6.2.4	Is the monitoring and recording frequency adequate for all monitoring parameters? Is it in line with the monitoring methodology?	/1/, /3/, /4/, /5/, /10/, /14/- /25/	DR/ CC	<table><tr><td>Parameter</td><td>PO_y</td></tr><tr><td>Description</td><td>Final quantity of PO produced in year y.</td></tr><tr><td>Monitoring</td><td>Continuous</td></tr><tr><td>Recording</td><td>Integrated daily and recorded monthly</td></tr></table> <table><tr><td>Parameter</td><td>Sol_y</td></tr><tr><td>Description</td><td>Quantity of make-up methanol solvent used in year y.</td></tr><tr><td>Monitoring</td><td>Continuous</td></tr><tr><td>Recording</td><td>At least monthly</td></tr></table> <table><tr><td>Parameter</td><td>$EF_{EL,y}$</td></tr><tr><td>Description</td><td>Emission factor for electricity generation in year y.</td></tr><tr><td>Monitoring</td><td>Please refer to section B.5.1.2 above</td></tr><tr><td>Recording</td><td>Please refer to section B.5.1.2 above</td></tr></table> <table><tr><td>Parameter</td><td>$EF_{CO2,i,y}$</td></tr><tr><td>Description</td><td>Weighted average CO₂ emission factor of fuel type i in year y.</td></tr></table>	Parameter	PO_y	Description	Final quantity of PO produced in year y.	Monitoring	Continuous	Recording	Integrated daily and recorded monthly	Parameter	Sol_y	Description	Quantity of make-up methanol solvent used in year y.	Monitoring	Continuous	Recording	At least monthly	Parameter	$EF_{EL,y}$	Description	Emission factor for electricity generation in year y.	Monitoring	Please refer to section B.5.1.2 above	Recording	Please refer to section B.5.1.2 above	Parameter	$EF_{CO2,i,y}$	Description	Weighted average CO ₂ emission factor of fuel type i in year y.	CL11, CL12, CL14, CL15 OK
Parameter	PO_y																																
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Checklist Question		Reference	MoV ¹	Comments		Conclusion	
				Monitoring	PP is requested to clarify on how it is possible to continuously monitor and record the value of $EF_{CO_2, I, y}$ Please refer to section B.5.1.2 above		
				Recording	PP is requested to clarify on how it is possible to continuously record the value of $EF_{CO_2, I, y}$ Please refer to section B.5.1.2 above		
				Parameter	$\eta_{Boiler, y}$		
				Description	Efficiency of the steam generating system in year y.		
				Monitoring	Default value (100%) Please refer to section B.5.1.2 above		
				Recording	Please refer to section B.5.1.2 above		
				Parameter	$SC_{HPPO, y}$		
				Description	Thermal energy consumption in PO production through the HPPO process in year y.		
				Monitoring	Calculated		
				Recording	Calculated		
				Parameter	$EC_{HPPO, y}$		
				Description	Electrical energy consumption in PO production through the HPPO process in year y.		
				Monitoring	Continuous		
				Recording	Integrated daily and recorded at least monthly		
				Parameter	$Q_{Propylene, y}$		
				Description	Quantity of propylene used in year y.		
				Monitoring	Continuous		
				Recording	At least once a month		

Checklist Question	Reference	MoV ¹	Comments	Conclusion								
			<table><tr><td>Parameter</td><td>$Q_{By-product,y}$</td></tr><tr><td>Description</td><td>Quantity of by-product produced in year y.</td></tr><tr><td>Monitoring</td><td>Continuous</td></tr><tr><td>Recording</td><td>At least once a month</td></tr></table>	Parameter	$Q_{By-product,y}$	Description	Quantity of by-product produced in year y.	Monitoring	Continuous	Recording	At least once a month	
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Description	Quantity of by-product produced in year y.											
Monitoring	Continuous											
Recording	At least once a month											
			<table><tr><td>Parameter</td><td>$FC_{i,y}$</td></tr><tr><td>Description</td><td>Quantity of NG combusted in the incinerator in year y.</td></tr><tr><td>Monitoring</td><td>Please refer to section 5.2.2 above</td></tr><tr><td>Recording</td><td>Please refer to section 5.2.2 above</td></tr></table>	Parameter	$FC_{i,y}$	Description	Quantity of NG combusted in the incinerator in year y.	Monitoring	Please refer to section 5.2.2 above	Recording	Please refer to section 5.2.2 above	
Parameter	$FC_{i,y}$											
Description	Quantity of NG combusted in the incinerator in year y.											
Monitoring	Please refer to section 5.2.2 above											
Recording	Please refer to section 5.2.2 above											
			<table><tr><td>Parameter</td><td>$COEF_{i,y}$</td></tr><tr><td>Description</td><td>CO₂ emission coefficient of Natural gas</td></tr><tr><td>Monitoring</td><td>Please refer to section B.5.1.2 above.</td></tr><tr><td>Recording</td><td>Please refer to section B.5.1.2 above.</td></tr></table>	Parameter	$COEF_{i,y}$	Description	CO ₂ emission coefficient of Natural gas	Monitoring	Please refer to section B.5.1.2 above.	Recording	Please refer to section B.5.1.2 above.	
Parameter	$COEF_{i,y}$											
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Monitoring	Please refer to section B.5.1.2 above.											
Recording	Please refer to section B.5.1.2 above.											
			<table><tr><td>Parameter</td><td>$Temp_{steam,HPPO,y}$</td></tr><tr><td>Description</td><td>Temperature of steam from captive thermal plant for HPPO process.</td></tr><tr><td>Monitoring</td><td>Continuous</td></tr><tr><td>Recording</td><td>At least monthly</td></tr></table>	Parameter	$Temp_{steam,HPPO,y}$	Description	Temperature of steam from captive thermal plant for HPPO process.	Monitoring	Continuous	Recording	At least monthly	
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			<table><tr><td>Parameter</td><td>$P_{EC,HPPO,y}$</td></tr><tr><td>Description</td><td>Pressure of steam from captive</td></tr></table>	Parameter	$P_{EC,HPPO,y}$	Description	Pressure of steam from captive					
Parameter	$P_{EC,HPPO,y}$											
Description	Pressure of steam from captive											

Checklist Question		Reference	MoV ¹	Comments		Conclusion					
				<table><tr><td></td><td>thermal plant for HPPO process</td></tr><tr><td>Monitoring frequency</td><td>Continuous</td></tr><tr><td>Recording frequency</td><td>At least monthly</td></tr></table>		thermal plant for HPPO process	Monitoring frequency	Continuous	Recording frequency	At least monthly	
	thermal plant for HPPO process										
Monitoring frequency	Continuous										
Recording frequency	At least monthly										
				Please refer to section B.6.2.1 above							
B.6.2.6	How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design? Please confirm the ability of the project participants to implement the described monitoring plant.	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	The project uses appropriate values from credible, published database or actual metered/monitored values, hence feasible with the project design. However, please refer to section B.6.2 above.		~~CL11,~~ ~~CL12,~~ ~~CL13,~~ ~~CL14,~~ CL15 OK					
B.6.3 Management/Quality Assurance/Quality Control											
B.6.3.1	Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	Procedures are detailed and are sufficient, hence accepted.		OK					
B.6.3.2	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	Data management and quality assurance and quality control procedures are sufficient to ensure that the emission reductions achieved can be report ex-post and verified.		OK					
B.6.3.3	Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	The monitoring records shall be archived for a period of the crediting period plus two years.		OK					
C.1 Crediting period											
C.1.1	What is the expected crediting starting date of the proposed project activity?	/1/, /3/, /4/, /5/, /10/, /14-/25/	DR/ CC	01-January-2013, this is after the start date of the project activity, hence accepted.		OK					
C.1.2	What is the length of the crediting period? Is it	/1/, /3/, /4/, /5/.	DR/	10 years, ending on 31-December-2022, has been		OK					

Checklist Question		Reference	MoV ¹	Comments	Conclusion
	clearly defined and reasonable?	/10/, /14- /25/	CC	clearly mentioned in section 1.6 of the VCS-PD.	
D.1 Environmental impacts					
D.1.1	Has an analysis of the environment impacts of the project activity been undertaken? Is it clearly and sufficiently described in the VCS PD?	/1/, /3/, /4/, /5/, /10/,	DR	Yes, <i>PP is requested to submit a copy of the EIA report approved by the Thai government.</i>	CL16 OK
D.1.2	Will the project create any adverse environmental effects? Are transboundary environmental impacts considered in the analysis?	/1/, /3/, /4/, /5/, /10/,	DR	The EIA has been approved by the Thai government, <i>PP is requested to submit the consent/ approval issued by the government to install and operate the project activity.</i>	CL16 OK
D.1.3	Is the analysis of the environmental impacts required by the legislation of the host Country? If yes, has the EIA has been approved by local Government? Does the approval contain any conditions that need monitoring?	/1/, /3/, /4/, /5/, /10/,	DR	Yes, this is required. PP has conducted an EIA, please refer to section D.1.1 above.	CL16 OK
D.1.4	Is it the project in line with the current environmental legislation in the host Country?	/1/, /3/, /4/, /5/, /10/,	DR	Please refer to section D.1.2 above	CL16 OK
D.1.5	Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/1/, /3/, /4/, /5/, /10/,	DR	Please refer to section D.1.2 above	CL16 OK
D.1.6	Are the sustainable development indicators in line with stated national priorities in the host country?	/1/, /3/, /4/, /5/, /10/,	DR	Please refer to section D.1.2 above	CL16 OK
E.1 Local stakeholder consultation					
E.1.1	Are the local stakeholders be invited by the PP prior to the publication of the VCS PD to the UNFCCC website?	/1/, /3/, /4/, /5/,	DR	Stakeholder consultation meeting was conducted before the implementation of the proposed VCS project activity on the 03-February-2010 as part of the EIA.	CL17 OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
		/10/,		<i>PP is requested to submit copies of the invitations sent</i>	
E.1.2	Are the stakeholders invited being considered as regards commenting the proposed project activity?	/1/, /3/, /4/, /5/, /10/,	DR	<i>PP is requested to submit the feedback taken from stakeholders.</i>	~~CL17~~ OK
E.1.3	Is the summary of the comments received from the stakeholders, provided in the VCS PD complete?	/1/, /3/, /4/, /5/, /10/,	DR	<i>PP is requested to submit the summary of comments received from the stakeholders</i>	~~CL17~~ OK
E.1.4	Has due account been taken by the project participants of any stakeholder comments received?	/1/, /3/, /4/, /5/, /10/,	DR	<i>PP is requested to detail the actions taken on account of the comments received during stakeholder meeting.</i>	~~CL17~~ OK
E.1.5	If a stakeholder consultation process is required by regulations/laws in the host Country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/1/, /3/, /4/, /5/, /10/,	DR	<i>PP is requested to detail the regulation requiring the stakeholder meeting to be conducted and how the same was compiled by the PP.</i>	~~CL17~~ OK

TABLE 2 RESOLUTION OF CORRECTIVE ACTION REQUESTS AND CLARIFICATION REQUESTS

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
CAR 1 1. PP is requested to update all relevant documents with respect to the latest VCS program guide version 3.5 and VCS standard version 3.4 dated 08-October-2013. 2. PP is requested to use the latest version of the VCS-PD	A.1.2, A.1.3	1. The referred most recent versions of the program guide and standard have been followed in preparing the project document. 2. The VCS-PD has been revised accordingly. <u>2nd response</u> 2a. The location of the project and the estimate of emission reductions has been indicated in the revised VCS-PD. 2b. The email address has been included in the revised VCS-PD.	1. Revision complete, hence accepted. 2. Following information is not available as required by the template: a. Section 1.1 - location of the project and an estimate of annual average and total GHG emission reductions and removals. b. Section 1.3 – the row email ID is empty. c. Section 1.9 – Geo coordinates not available. d. Section 2.1 -Title and version number of tools applied by the project CAR 1 is open after 1st review. <u>2nd response:</u> 2a. Available now. 2b. Available now.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
		2c. The Geo-coordinates are included in the revised VCS-PD. 2d. The title and version of the applied tools has been indicated in the revised VCS-PD.	2c. Available now, consistent with site visit observations. 2d. Available now, hence accepted. CAR 1 is closed.
CAR2 The project is estimated to achieve an emission reduction of more than 300,000 tonnes of CO ₂ e per year, however has been categorized as project as per section 1.7 of the VCS-PD, PP is requested to correct the VCS-PD as appropriate.	A.4.2	The scale of the project has been corrected in the revised VCS-PD.	The emission reductions estimated is less than 300,000tCO ₂ /year and termed as project. Hence accepted. CAR 2 is closed.
CAR3 1. PP is requested to transparently mention on whether the upstream emissions from reagent(s) production is part of the project boundary. 2. PP is requested to provide a diagram or map of the project boundary, showing clearly the physical locations of the various installations or management activities taking place as part of the project activity / equipments / main stages of PO production process and waste treatment and disposal. 3. PP is requested to detail all the reagents being used and the wastes obtained and its treatment transparently.	B.2.1 to B.2.5	1. The table in section B.2.3 clearly depicts that emissions associated with the production of baseline reagents (Cl ₂ and NaOH) and emissions associated with the production of project reagents (H ₂ O ₂ and methanol) are included in the project boundary. 2. Block diagram or process flow diagram has now been included in the revised VCS-PD. 3. The block/process flow diagram clearly depicts the reagents and waste streams.	1. Requested information is transparently available in section B.2.3, hence accepted. 2. The block diagram is transparent on the details requested, hence accepted. 3. The block diagram is transparent on the details requested, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
4. PP is requested to detail the mass and energy balance, flow of process, GHG sources, parameters monitored and the location of monitoring equipments. 5. The project boundary is not transparent on the grid to which the project is connected to. 6. The project boundary is not transparent on the source of heat supplied.		4. The mass and energy balance along with the metering locations are depicted in the block diagram. 5. The VCS-PD has been revised with the insertion of the following clarifying statement: The project is connected to the Glow grid which in turn is connected to the national grid. Therefore, the national grid is considered as the ultimate connected grid. 2nd response 5. Please refer to the weblink: http://www.glow.co.th/ . It provides the details of the various plants (http://www.glow.co.th/index.php?p=product_business_overview-index) and the costumers (http://www.glow.co.th/index.php?p=partner_ourcustomer-index). Further, during the site visit it was confirmed that the project is connected to the Glow grid. 6. The VCS-PD has been revised with the insertion of the following clarifying statement: The heat (steam) requirements of the project are met by the steam extracted from the cogeneration plants of Glow grid. 2nd response 6. Please refer to the weblink:	4. The block diagram is transparent on the details requested, hence accepted. 5. PP is requested to submit evidence in support of the statement that the project activity is connected to Glow grid and that the Glow grid is connected to the National grid. 2nd response: Response consistent with site visit observations, hence accepted. 6. PP is requested to submit evidence for the same. 2nd response: Response consistent with site visit

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
7. The project boundary is not transparent on the fuels used.		http://www.glow.co.th/index.php?op=product_business_overview-index which indicates that Glow also sells steam to the industrial customers in Map Ta Phut Industrial Estate and nearby industrial estates. 7. The VCS-PD has been revised with the insertion of the following clarifying statement: The fuel requirement is for incineration purpose. Natural gas is being used as the fuel.	observations, hence accepted. 7. The information is now made transparent on the use of NG, hence accepted. CAR 3 is closed.
CAR4 PP is requested to clarify on the use of step 0 of the additionality tool, incase step 0 is not applied, PP is requested to transparently document stepwise application of the CDM “Guidelines on common practice”	B.4.6.1 to B.4.6.5, B.4.7.1	Step 0 of the additionality tool has now been explicitly presented in the revised VCS-PD.	The revision is appropriate, hence accepted. CAR 4 is closed.
CL 1 1. Production capacity is mentioned to be 430 kilotons per annum of PO. PP is requested to submit evidence for the production capacity of the project plant. 2. PP is requested to submit the purchase order and the commissioning certificate for the project activity.	A.2.1 to A.2.3, A.4.4	1. The name plate capacity of 390 kilotons per annum (KTA) of PO is mentioned in the revised VCS-PD. This is evident from the submitted news release documents. 2. As the entire plant is a Greenfield project with several components so there are several purchase orders. Some of the evidences for purchasing critical equipment in the HPPO process along with the	1. Confirmed capacity of plant with the news release dated 04/01/2012. This was verified to be publicly available at http://www.dow.com/polyurethane/news/2012/20120104a.htm on 04/09/2014, hence accepted. 2. Purchase order No. 92002926 dated 08/Jul/2008 amended on 20/Jan/2011 for Compressor motors, Tag -CM3130; Purchase order No. 92002952 dated 11/Jul/2008 for Propylene compressor motors Tag – CM4130 & CM41308;

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
		commissioning certificate are being submitted.	Purchase order No. 92003179 dated 05/Nov/2008 amended on 25/Feb/2009 for Compressor motors for MRU package; Purchase order No. 93000078 dated 19/Mar/2009 amended on 16/Jul/2010 for Inline static mixers; Purchase order No. 92003954 dated 17/Feb/2010 for D-2500 Liquid jet mixer; Purchase order No. 92002937 dated 09/May/2008 for Centrifugal compressor; Purchase order No. 92002938 dated 29/April/2008 for Propylene Centrifugal compressor; have been submitted by the PP. Date of commissioning is being confirmed by email dated 18/09/2011 from Mr. Andrew Liveris, Chief Operating Officer, Dow Chemicals Limited on commissioning of the plant and the news release dated 04/01/2012 publicly available at http://www.dow.com/polyurethane/news/2012/20120104a.htm , hence accepted.
3. As required by the VCS PD template, PP is requested to include the list and arrangement of the main manufacturing / production technologies, systems and equipments involved.		3. Please refer to the Block/process flow diagram as referred earlier.	3. The block diagram included now meets requirement, hence accepted.
4. PP is requested to include the types and levels of services in terms of mass or energy flows provided by the systems and equipment that are being installed and their relation, if any, to other manufacturing/production equipment and systems outside the project boundary. PP is also requested to clearly explain on how the same types and levels of services		4. Please refer to the Block/process flow diagram as referred earlier. In the context of baseline scenario the mass and energy values have been sourced independent 3 rd party sources, as per the requirements of the methodology.	3. The block diagram included now meets requirement, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
provided by the project would have been provided in the baseline scenario 5. While it is transparent in the VCS PD that the project activity is a green field project, as it is situated in a manufacturing complex involving production of chemicals other than PO, PP is requested to confirm on the list of facilities / shared facilities, systems and equipment in operation under the existing scenario prior to the implementation of the project and would be used in the project scenario. 6. Lifetime of the project activity is mentioned to be 30 years in the VCS PD; PP is requested to submit evidence for the same.		5. Please refer to the Block/process flow diagram as referred earlier. 6. The lifetime of the plant has been taken as a proxy based on the existing operating CHPO plants of DOW. <u>2nd response</u> 6. Please refer to the email from DOW indicating the lifetime of the plant. It is expected that such a plant will run at least 25 years, but usually are run far longer (50+ years with modernization projects). Nevertheless, on a conservative note we have taken the lifetime as 30 years. Moreover, the crediting period is only 10 years.	5. The block/process diagram is transparent on shared facilities, hence accepted. 6. PP is requested to provide evidence in support of the same as required by the Tool to determine the remaining lifetime of equipment 2nd response: Since DOW themselves have put up this plant and have operated many such propylene oxide plants, this is being accepted in line with the Tool to determine the remaining lifetime of equipment CL1 is closed
CL2 1. VCS PD gives contact information and roles/responsibilities for the project proponent; however PP is requested to	A.3.1	1. The company affidavit as proof for contact person is being submitted.	1. The company affidavit from the Department of Business Development, Ministry of Commerce, Thailand is

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
submit appropriate evidence in support of the same. 2. As per the VCS PD the PP is South Pole Carbon Asset Management Ltd., however the contract / request for validation has been signed by South Pole Carbon (Thailand) Co. Ltd, PP is requested to clarify this difference.		2. The VCS-PD has been revised. South Pole Carbon (Thailand) Co. Ltd, is the carbon consultant involved in this project. <u>2nd response</u> 2. Please note that South Pole Carbon (Thailand) Co. Ltd, is a fully owned subsidiary of South Pole Carbon Asset Management Limited. Therefore the information indicated on the cover page and thereafter in section 1.4 is correct as the contact of DOW is with South Pole Carbon (Thailand) Co. Ltd.	submitted. The revision in the VCS PD is consistent with the evidence submitted, hence accepted. 2. OK, however the information in the cover page is yet to be revised. 2nd response: 2. Information in rest of the VCS-PD is consistent with the contract signed with RINA, hence accepted. CL2 is closed
CL3 PP is requested to confirm on the source of funding for the project activity.	A.5.1	The financial statement for MTP HPPO is being submitted to confirm the source of funding for the project.	Verified Financial statement for the year ending 31/Dec/2013, dated 21/April/2014 from Deloitte Touche Tohmatsu Jaiyus Audit Co., Ltd. No evidence of diversion of ODA funds observed. Hence accepted. CL3 is closed.
CL4 1. PP is requested to transparently mention the version number of the tools used. 2. VCS-PD does not refer to the Tool to determine the baseline efficiency of thermal or electric energy generation systems to	B.1.2, B.1.3, B.3.3, B.4.1, B.4.7.1	1. The version number of the latest tools and guidelines applied have been mentioned in the revised VCS-PD. 2. The heat/steam to the project activity is supplied by a	1. Please refer to CAR 1. 2. Consistent with site visit observation, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
determine the efficiency of the boiler. 3. PP is requested to provide PO copy. 4. PP is requested to provide mass balance as from the supplier of the plant / 3rd party report. 5. PP is requested to detail on how the individual requirements of the tools used are met		cogeneration unit connected to the electricity grid too. As a conservative estimate and to avoid double counting the emission factor for heat/steam has been taken as zero. Therefore, the Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the efficiency of the boiler is redundant and has not been applied. 3. Please refer to earlier response (CL 1, point 2). 4. Please refer to the block/process flow diagram. <u>2nd response</u> 4. Please note that the design of the plant is being done by DOW and the block diagram included in the VCS-PD is sourced from DOW. 5. The tools applied are: <i>Tool for the demonstration and assessment of additionality</i>, <i>Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion</i> and <i>Tool to calculate the emission factor for an electricity system</i>. The application of the above referred tools has been carried out using the stepwise approach provided in the respective tools. There are no requirements stated in the tools other than already indicated in the	3. Please refer to earlier response (CL 1, point 2). Accepted. 4. PP is requested to provide evidence that the same has been sourced from the supplier of the plant / 3rd party report. 2nd response: 4. Response confirmed with site visit and email dated 14 Aug 2014. 5. Verified that there are no requirements stated in the tools other than already indicated in the methodology, hence accepted. CL4 is closed

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
		methodology.	
CL5 1. PP is requested to provide evidence that there is no hindrance for the PP to install CHPO based PO plant for the same capacity. 2. PP is requested to transparently list all the legal requirements pertaining to the implementation of the project plant (with baseline and project technology) in Thailand. 3. VCS-PD is not transparent on the application of the step 0 of the CDM - Tool for the demonstration and assessment of additionality. 4. PP is requested to clarify whether the list of PO manufacturing plants as detailed in the VCS PD (at DOW/ in the region/ World) include the plants under implementation and under advanced stages of planning at the time of going ahead with the project and submit evidence. 5. PP is requested to detail on the list of PO	B.3.1	1. The environmental laws existing in Thailand have been checked and they have not been found to be restricting the installation of CHPO plants. Further, as demonstrated in the additionality section, there is a prevalence of CHPO plants in the Asia Pacific region. 2. The general legal requirements for putting up a plant / environmental laws can be found at the following link: http://www.pcd.go.th/info_serv/en_regulation.html. Further, there is also a Chlor-Alkali plant in Map Ta Phut as evident from the following link: http://www.adityabirlachemicals.com/products/chlor_alkali/companies_producing_chlor_alkalis.html. 3. Step 0 of the additionality tool has now been explicitly presented in the revised VCS-PD. 4. Please refer to the submitted Nexant report which provides reference to the project activity as well. 5. Please refer to the Nexant report,	1. Cross verified with publicly available sources, while there are no PO plants in Thailand other than the project activity, there is no evidence that CHPO based PO plants are not permitted in Thailand. Also from the link in the second response, it is evident that Chlor-Alkali plants are permitted in Thailand. Hence the reply from PP is accepted. 2. As above. Accepted. 3. Step 0 of the additionality tool has now been explicitly presented in the revised VCS-PD. Hence accepted. 4. Report verified, consistent with PP's response, hence accepted. 5. Report verified, consistent with PP's

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
manufacturing plants (including their capacity and technology used) under implementation and under advanced stages of planning at the time of submitting the VCS-PD for validation and submit supportive evidence.		table 5.5.	response, hence accepted. CL 5 is closed
CL6 1. Credible evidence on the statement relating to the availability of lime. 2. PP to clarify on whether all other reagents, except lime are available close to the project, by listing the reagents required, its source and approximate distance from the project site, along with necessary supportive evidences. 3. PP is requested to provide the supportive evidence to demonstrate that there is no commercially available technology to produce (only) PO other than CHPO process.	B.3.2, B.3.3	1. The CHPO-lime option has been not considered owing to non-availability as well as conservative reasons. The lime process has higher cost of production as can be seen from the Nexant report, section 2.3, table 4.4 and table 4.5. 2. Apart from propylene which is anyway available at the site, the Chlorohydrin process requires brine (salt-water) which too is close-by. Further, there is also a Chlor-Alkali plant in Map Ta Phut as evident from the following link: http://www.adityabirlachemicals.com/products/chlor_alkali/companies_producing_chlor_alkalis.html. 3. Please refer to the Nexant and SRI reports depicting other technologies for PO production.	1. Report verified, consistent with PP's response, hence accepted. 2. Web-link verified, consistent with PP's response, hence accepted. 3. Report verified, consistent with PP's response, hence accepted. CL 6 is closed
CL7 PP is requested to make it transparent in the VCS-PD on whether the baseline scenario sufficiently takes into account relevant national and/or sectoral policies	B.3.4	The baseline scenario is considered as the Chlorohydrin technology. The significant presence of	Cross verified with publicly available sources, while there are no PO plants in Thailand other than the project activity,

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
(E+ / E-), macro-economic trends and political aspirations.		Chlorohydrin technology in the Asia Pacific region in itself is an evidence of accounting the sectoral policies, macro-economic trends and political aspirations.	there is no evidence that CHPO based PO plants are not permitted in Thailand. Also from the link in the second response, it is evident that Chlor-Alkali plants are permitted in Thailand. Hence the reply from PP is accepted. CL7 is closed
CL8 PP is requested to submit credible evidence in support of the start date of the project activity.	B.4.3.1, B.4.3.2, B.4.7.1	Please refer to the commissioning certificate for the project activity.	Date of commissioning is being confirmed by email dated 18/09/2011 from Mr. Andrew Liveris, Chief Operating Officer, Dow Chemicals Limited on commissioning of the plant and the news release dated 04/01/2012 publicly available at http://www.dow.com/polyurethane/news/2012/20120104a.htm , hence accepted. CL 8 is closed.
CL9 1. PP is requested to submit credible evidence consistent with the requirements as set out in CDM “Guidelines for objective demonstration and assessment of barriers” against each of the statement made in the section 2.5 of the VCS-PD under barrier analysis. 2. PP is requested to list the technological barriers faced by the PP in the Antwerp (Belgium) HPPO plant and detail on the same were handled and submit evidence. 3. PP is requested to clarify on when the	B.4.5.3, B.4.5.8, B.4.7.1	1. Please refer to the submitted Nexant and SRI reports referred while demonstrating the barriers objectively. 2. The revised VCS-PD establishes the first-of-its-kind barrier across Asia-Pacific and technological barrier based on percentage share across World of applied technology. 3. The financial statement depicting	1. The revised VCS PD addresses the requirements of the “Guidelines for objective demonstration and assessment of barriers”, hence accepted. 2. The VCS PD no longer refers to the risk of technological failure, hence accepted. 3. Available in section 20.1 of the report

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
decision to go ahead with the project was taken and submit evidence. 4. VCS-PD mentions “The warm and moist climate of Thailand will also have huge consequences on the long term performance of the plant. Anti-corrosion and proper cooling system is required” this is common for the baseline plant also, PP is requested to clarify. 5. VCS-PD mentions “The scale-up from 300 to 390 kT will require redesigning the whole plant”, this scale-up/ scale-down is common for the baseline plant also, PP is requested to clarify.		the agreement date 9th June 2008 as decision to go ahead with the project activity is being submitted. 4. The VCS-PD has been revised removing the reference to the mentioned statement. The project activity has been demonstrated as first-of-its-kind in Thailand/Asia Pacific region. 5. The VCS-PD has been revised removing the reference to the mentioned statement. The project activity has been demonstrated as first-of-its-kind in Thailand/Asia Pacific region.	hence accepted. 4. The VCS PD no longer refers to the risk of technological failure, hence accepted. 5. The VCS PD no longer refers to the risk of technological failure, hence accepted. CL 9 is closed.
CL10 PP is requested to detail transparently in the VCS PD on how VCS alleviates the identified barriers using the “Guidelines for objective demonstration and assessment of barriers”.	B.4.5.9, B.4.7.1	The revised VCS-PD establishes the barriers in accordance with the <i>Guidelines on additionality of first-of-its-kind project activities</i> and also applying <i>Guidelines for Objective Demonstration and Assessment of Barriers</i>.	The revised VCS-PD establishes the barriers in accordance with the “Guidelines on additionality of first-of-its-kind project activities” and also applying “Guidelines for Objective Demonstration and Assessment of Barriers”, hence accepted. CL 10 is closed.
CL11 1. PO_y is the Quantity of PO produced in year y (tons), value applied 337,206 tons as per the VCS-PD, the same is not consistent with the ER sheet (430,000 tons), PP is requested to clarify and submit evidence. 2. eC_{Chlor-Alkali, y} is the Energy consumption per ton of Cl₂ production (MWh/tCl₂), value	B.5.1.2, B.5.1.3, B.5.2.2, B.5.4.1 to B.5.4.4, B.6.1.2, B.6.2.1 to B.6.2.6	1. The quantity stated is for propylene and not PO. Nevertheless, please refer the revised VCS-PD. 2. The revised ER sheet also contains the reference to the stated	1. Revised values consistent with ER sheet and the name plate capacity, hence accepted. 2. Mentioned information could not be located in the ER sheet version 1.1.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
applied 2.2, sourced from Multilateral Investment Guarantee Agency Environmental Guidelines for Chlor-Alkali Industry, a credible independent third party; however the source for the same is not transparent in the ER sheet. 3. $EF_{EL,y}$ is the Emission factor for electricity generation in year y (tCO_2/MWh), calculated according to the 'Tool to calculate the emission factor for an electricity system' value applied 0.5113, source is not consistent in the ER sheet. PP is requested to submit the stepwise calculation of emission factor as per the tool applied and submit a spreadsheet detailing the calculations and values used. The source of base data is mentioned to be annual report of power plant in section 4.2 of the VCS-PD; PP is requested to clarify on how this is consistent with the requirement of the applied CDM Tool to calculate the emission factor for an electricity system.		source. 2. The source has been included in the revised ER sheet. 3. The grid emission factor computation is being submitted. 2nd response 3. Although the details of the grid emission factor are not included in the VCS-PD, the separate spreadsheet for the grid emission factor computation by Thai DNA is being submitted.	2nd response: 2. The source has been included in the revised ER sheet. Hence accepted. 3. Required information is not available in the revised VCS PD. 2nd response: 3. As per clause 93 and 95 Methodological tool: Tool to calculate the emission factor for an electricity system Version 04.0, "The calculation of the operating margin and build margin emission factors should be documented electronically in a spread sheet that

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
4. SSC_{CHPO} is the Specific thermal energy consumption ratio in the PO production through CHPO process (TJ/ton of PO), value applied is 0.009795, sourced from Nexant report on HPPO, however the page numbers quoted in the VCS-PD and the ER sheet are not consistent. The value applied is not directly available in the report; PP is requested to make the calculations made transparently available in the VCS-PD using the values available in the source document. 5. EF_{CO₂,i,y} is the Weighted average CO₂ emission factor of fuel type i in year y (tCO₂/TJ), value applied 56.1, IPCC default value for natural gas, PP is requested to clarify the logic behind choosing natural gas as fuel, why default value (option d) has been		3rd response 3. The grid emission factor details have been included in appendix1 of the revised VCS-PD. 4. The confusion is owing to the pdf pages and page numbering stated in the report. The revised VCS-PD refers to the page numbers stated in the report. 2nd response 4. The references have been corrected in the VCS-PD and spreadsheet referring to the exact tables instead of page numbers to avoid confusion. Further a separate sheet for conversion of steam values into energy terms along with the source is included. 5. Natural gas is used as the fuel in the incinerator. As a conservative approach, the default value is being used instead of the lower limit value, since project emissions too	should be attached to the CDM-PDD.” “The data should be presented in a manner that enables reproducing of the calculation of the build margin and operating margin grid emission factor.” 3rd response: 3. Revision in VCS-PD appropriate, hence accepted. 4. Page numbers referred are still not consistent. Also the conversions made are not transparent. 2nd response: 4. ER sheet is now transparent and consistent with VCS-PD, hence accepted. 5. Consistent with site visit observations hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
selected and also on why the lower limit (since baseline) value of the uncertainty at a 95% confidence interval is not taken as required by the tool applied. Further the value applied is not consistent with the value used in ER sheet. 6. $\eta_{Boiler,y}$ is the Efficiency of the steam generating system, value applied is 100%, PP is requested to make it transparent in the VCS-PD on how it is consistent with the Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the efficiency of the boiler. 7. SEC_{CHPO} is the Specific electrical energy consumption ratio in the PO production through CHPO process (MWh/ton of PO), value applied is 0.100, sourced from Nexant report on HPPO, however the page numbers quoted in the VCS-PD and the ER sheet are not consistent. The value applied is not directly available in the report; PP is requested to make the calculations made transparently available in the VCS-PD using the values available in the source document. 8. $COEF_i$ is the CO₂ emission coefficient of fuel type i (tCO₂/mass or volume unit). Value applied 2.693, sourced as per Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion, however the calculation is not transparently available either in VCS-PD and ER sheet.		are linked to it. 6. Please refer to earlier response (CL 4, point 2). 7. The confusion is owing to the pdf pages and page numbering stated in the report. The revised VCS-PD refers to the page numbers stated in the report. 8. Please refer to the revised VCS-PD 2nd response 8. The basis of arriving at the value	6. Please refer to earlier response (CL 4, point 2). Hence accepted. 7. The information is now consistent; and the conversions made are transparent, hence accepted. 8. Requested information is still not transparent. Also the ER sheet is not transparent on how this is factored in ER calculation. 2nd Response: 8. Since this is part of project emissions,

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
		has been included in the revised VCS-PD along with the source. For the estimation the waste quantity and fuel consumption are assumed to be zero. 3rd response 8. The use of natural gas is very minimal, just to maintain the pilot flame in the incinerator. This amount will be the same as in the baseline. Further, the Nexant report too does not indicate any natural gas usage. Moreover the waste gases to be incinerated are flammable and have already been accounted as project emissions.	PP is requested to use the design values to arrive at the most conservative estimate of emission reductions. 3rd response: 8. Consistent with site visit observations hence accepted. CL 11 is Closed after third review
CL12 1. pe_{HP} is the Quantity of CO₂ that would be emitted per ton of H₂O₂ (tCO₂/ tH₂O₂), value applied 0.533, the weblink given as reference is not active, PP is requested to update the same. 2. pe_{Sol} is the Quantity of CO₂ that would be emitted per ton of Solvent (tCO₂/ ton of Solvent), the VCS-PD is not transparent on the value used . 5.285 is the value applied in ER sheet, sourced from Table 3.12,	B.5.2.2, B.5.3.3, B.5.4.1 to B.5.4.4, B.6.1.2, B.6.2.2 to B.6.2.6	1. The reference to the web-link has been removed in the revised VCS-PD. The source document is being submitted. 2. The VCS-PD has been revised clarifying the value applied and source.	1. Consistent with the evidence submitted, the submitted Environmental Product Declaration has been reviewed by the Swedish National Testing and Research Institute (SP), who is an accredited certification body by SWEDAC. It is approved according to the Product Specific Requirement, PSR 2000:5 for Chemical Products and the Swedish Environmental Council requirements for environmental product declarations, MSR 1999:2. Hence accepted. 2. While there are many values, PP is requested to clarify on why 0.310 has been selected.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
Chapter 3: Chemical Industry Emissions, IPCC 2006 report, the highest value, hence conservative, however PP is requested to clarify the same in the VCS-PD.		2nd response 2. Methanol is sourced from Petronas Chemicals Methanol Sdn Bhd, Ranche-ranche Industrial Estate, Labuan, Malaysia. The plant uses Lurgi's MegaMethanol technology (http://www.specialchem4coatings.com/news-trends/displaynews.aspx?id=3460). The choice of EF corresponds to the Mega Methanol technology. 3rd response 2. It can be noted that Petronas Methanol (Labuan) Sdn. Bhd. (PMLSB) produces methanol using Lurgi's low-pressure combined technology and the 2nd plant uses Lurgi's MegaMethanol technology, with a capacity of more than double that of the first plant (http://en.wikipedia.org/wiki/Petronas_Methanol). The EF for the Lurgi Low Pressure Process technology is 0.267 whereas for Lurgi Mega Methanol Process is 0.310. In light of the above, as conservative approach the EF corresponding to Mega Methanol technology has been used.	2nd response: 2. PP is requested to explain how the project activity will source methanol only from this plant and that the plant will continue to use only Lurgi's MegaMethanol technology for the entire lifetime of the project activity. 3rd response: 2. The response from PP is consistent with interviews had during site visit, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
3. sol_y is the Quantity of solvent (tons) required per ton of PO, value applied is 0.0139, source is not transparently available in the VCS-PD, ER sheet mentions the source to be Nexant report for HPPO, cross checked with Table 4.3 of the report and found consistent, however, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. 4. SSC_{HPPO} is the Specific thermal energy consumption ratio in the PO production through HPPO process (TJ/ton of PO). Value applied is not transparently available in the VCS-PD, ER sheet mentions the value to be 0.009217 and the source to be Nexant report for HPPO, the value is not directly available in the page mentioned. Further, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. 5. SEC_{HPPO} is the Specific electrical energy consumption ratio in the PO production through HPPO process (MWh/tonne of PO). Value applied is not transparently		3. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity. 4. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity. <u>2nd response</u> 4. The source of data has been corrected in the revised spreadsheet. The value corresponds to the design value also indicated in the block diagram. 5. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity.	3. Chosen from the design values of the plant as available in the block diagram available in section 2.3 of the VCS PD. This is conservative to the value available in Nexant report, Further it is noted that ex-post emission reduction calculations are based on actual measurements, hence accepted. 4. The ER sheet still uses the values from the Nexant report. PP is requested to clarify. 2nd response: 4. Correction in ER sheet appropriate, hence accepted. 5. The ER sheet still uses the values from the Nexant report. PP is requested to clarify.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
available in the VCS-PD, ER sheet mentions the value to be 0.108 and the source to be Nexant report for HPPO, the value is not directly available in the page mentioned. Further, as per the Methodology applied this is to be sourced from the design details of the project. PP is requested to clarify. 6. $FC_{i,y}$ is the Quantity of fuel type i combusted in the incinerator during the year y (mass or volume unit/year). This has been excluded; PP is requested to justify the same with credible evidence on how this is conservative as it is part of project emissions. 7. $Q_{\text{Propylene}, y}$ is the Quantity of propylene used in year y (tons), value applied 337,206 sourced from Nexant report, this value is not directly available in the report and calculated based on specific consumption, PP is requested to make this calculation		<u>2nd response</u> 5. As above 6. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity. <u>2nd response</u> 6. For estimates the quantity of NG for incineration is assumed to be zero. <u>3rd response</u> 6. Please refer to 3rd response under CL11 point 8. 7. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity.	2nd response: 5. Correction in ER sheet appropriate, hence accepted. 6. The response provided does not address the query raised. Also ER sheet does not account for use of NG in incinerator. 2nd response: 6. Please refer to CL 11 point 8. <u>3rd response</u> 6. Please refer to 3rd response under CL11 point 8. This part of CL12 is closed 7. Value applied is consistent with the design values. How the ER sheet still refers to Nexant report. PP is requested to correct as appropriate.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
transparent in the VCS-PD. The ER value applied in the ER sheet is consistent with the source document. 8. $Q_{\text{Byproduct}, y}$ is the Quantity of monopropyleneglycol produced in year y (tons), this has been excluded for simplification, conservative, however this is not transparently available in the VCS-PD.		2nd response 7. The source of data has been corrected in the revised spreadsheet. The value corresponds to the design value also indicated in the block diagram. 8. The ER sheet and the VCS-PD have been revised taking into account the design values for the project activity.	2 nd response: 7. Correction in ER sheet appropriate, hence accepted. 8. Value applied is consistent with the design values. Hence accepted. CL12 is closed after third review.
CL13 PP is requested to transparently document the parameters available at the time of validation as required by the tools applied and detail on how they have been complied.	B.6.1.1, B.6.1.2 to B.6.1.4 B.6.2.2 to B.6.2.6	The revised VCS-PD transparently documents the parameters available at the time of validation in accordance with the methodology and tools applied.	$EF_{EL,y}$, Emission factor for electricity has been included now. All parameters as required by the methodology and tools applied have been identified, hence accepted. CL 13 is closed
CL14 PP is requested to transparently document the parameters to be monitored ex-post as required by the tools applied and detail on how they have been complied.	B.6.2.1 to B.6.2.6, B.6.2.2 to B.6.2.6	The revised VCS-PD transparently documents the parameters to be monitored ex-post in accordance with the methodology and tools applied.	All parameters as required by the methodology and tools applied have been identified, hence accepted. CL 14 is closed
CL15	B.6.2.3, B.6.2.6		

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
1. PO quantity (tons) is measured using volume flowmeter; PP is requested to clarify on how the volume to weight conversion is done.		1. The revised VCS-PD clarifies the monitoring equipment type.	1. Consistent with site visit observation hence accepted.
2. Sol _y – Methanol quantity (tons) is measured using volume flowmeter; PP is requested to clarify on how the volume to weight conversion is done.		2. The revised VCS-PD clarifies the monitoring equipment type.	2. Consistent with site visit observation hence accepted.
3. Accuracy of the volume flow meter used for measurement of solvent quantity is not transparent in the VCS-PD		3. The accuracy of the meters are stated in the revised VCS-PD.	3. Consistent with site visit observation hence accepted.
4. VCS-PD is not transparent on the monitoring equipment used for the measurement of quantity of propylene used in the project activity.		4. The monitoring equipment used for measurement of propylene quantity is stated in the revised VCS-PD.	4. Consistent with site visit observation hence accepted.
5. VCS-PD is not transparent on the accuracy of the equipment used for the measurement of quantity of propylene used in the project activity.		5. The accuracy of the meters are stated in the revised VCS-PD.	5. Consistent with site visit observation hence accepted.
6. VCS-PD is not transparent on the monitoring equipment used for the measurement of quantity of by-product in the project activity.		6. The monitoring equipment used for measurement of by-product quantity is stated in the revised VCS-PD.	6. Consistent with site visit observation hence accepted.
7. VCS-PD is not transparent on the accuracy of the equipment used for the measurement of quantity of by-product in the project activity.		7. The accuracy of the meters are stated in the revised VCS-PD.	7. Consistent with site visit observation hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
8. PP is requested to detail on the responsible person/entity who will perform the calibration and the accreditation requirement of the calibration agency.		8. The revised VCS-PD provides the details about the calibration requirements. <u>2nd response</u> 8. The VCS-PD indicates that the project leader will be responsible: 'The project leader will monitor the overall plant's performance, ensuring proper and timely calibration (in accordance with the manufacturer specifications or national standard) of systems, data acquisition and storage.' <u>3rd response</u> 8. The responsible person is a person who works under site maintenance department but dedicated to specific plant, the position called Reliability Engineer for PO plant. This person is responsible for all predictive and preventive program to maintain the high level of plant reliability which also include the scope to setting up all equipment/instruments calibration program. The calibration of monitoring equipment will be done on regular intervals at site, based on master equipments traceable to industry/national standards.	8. Requested information is not transparent in the VCS PD. 2nd response: 8. PP is requested to clarify on how this meets clause 105 and 106 of the project standard. 3rd response: 8. VCS-PD has been revised as per the response here, hence accepted.
9. PP is requested to submit the specification sheets of meters used for		9. The requested information is	9. Information could not be located in the

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
measurement parameters monitored. 10. PP is requested to clarify on how it is possible to continuously monitor and record the value of $EF_{CO_2, I, y}$, also PP is requested to clarify on how it is possible to continuously record the value of $EF_{CO_2, I, y}$		being submitted. 2nd response 9. The details of the meters are already indicated in the VCS-PD. These could be also confirmed based on the site visit. 10. The revised VCS-PD corrects this error.	supportive files submitted along with first response. 2nd response: 9. Information consistent with site visit observations, hence accepted. 10. VCS PD has been revised accordingly, hence accepted. CL 15 is closed after third review
CL16 1. PP is requested to submit a copy of the EIA report approved by the Thai government. 2. PP is requested to submit the consent/ approval issued by the government to install and operate the project activity.	D.1.1 to D.1.6	1. The requested document is being submitted. 2. The requested document is being submitted.	1. Information could not be located in the supportive files submitted along with first response. 2. Information could not be located in the supportive files submitted along with first response.
		2nd response The license to operate from the government authorities is being submitted.	2nd response: Acknowledgement on implementing notification dated 3 October 2011, from Industrial Estate Authority of Thailand submitted. Hence accepted. CL 16 is closed.
CL17 1. PP is requested to submit copies of the invitations sent	E.1.1 to E.1.5	1. The requested documents are being submitted.	1. 82 announcement letters from 19/1/2010 by post has been sent including

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation Conclusion
2. PP is requested to submit the feedback taken from stakeholders. 3. PP is requested to submit the summary of comments received from the stakeholders 4. PP is requested to detail the actions taken on account of the comments received during stakeholder meeting. 5. PP is requested to detail the regulation requiring the stakeholder meeting to be conducted and how the same was compiled by the PP.		2. The requested documents are being submitted. 3. The requested documents are being submitted. 4. The stakeholder consultation document is being submitted. 5. The stakeholder consultation document is being submitted.	Mathaput authority, Banchang authority, Banchan sub-district authority, Palar authority and Office of Asia industrial park. Hence accepted. 2. Number of participants = 619 persons, public announcements = 190 medias, hence sufficient participation is evidenced. 3. As per the EIA report, the comments received were positive. 4. As per the EIA report, the comments received were positive. 5. The information is now transparent in the revised VCS PD, hence accepted. CL 17 is closed.

TABLE 3 FORWARD ACTION REQUEST

Forward action request	Reference to Table 2	Response by project participants Validation Conclusion
FAR 1		
No FARs were raised.		



RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:

A. Cyril Augustus Arokiasamy

We declare that Mr/Mrs/Ms:

è qualificato come¹:
is qualified as:

**CDM-TEC, CDM-VAL, CDM-VER, CDM-TL, CDM-FIN-EXP,
GS-TEC, GS-VAL, GS-VER, GS-TL, GS- FIN-EXP,
SCS-TEC, SCS-VAL, SCS-VER, SCS-TL, SCS- FIN-EXP
VCS-TEC, VCS-VAL, VCS-VER, VCS-TL, VCS- FIN-EXP, JI-TEC**

per le seguenti aree tecniche:
for the following technical areas:

1.1, 1.2, 2.2, 3.1, 4.5, 4.10, 5.1, 11.1, 13.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation from fossil fuel and biomass including thermal electricity from solar	1
1.2	Energy generation from renewable energy sources	1
2.2	Heat Distribution	2
3.1	Energy Demand	3
4.5	Rubber and Plastics	4
4.10	Fuel switching and/or energy efficiency and/or waste heat/gas/pressure recovered and utilization for power generation at manufacturing industries	4
5.1	Chemical process industries	5
11.1	Chemical process industries	11
13.1	Waste Handling and Disposal	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	30-06-2010	-
10	10-10-2013	Updated qualification as VCS-VER, VCS-VAL, VCS-TL

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS : Verified Carbon Standard:
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports



RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Kumar Praveen Krishnan

è qualificato come¹:
is qualified as:

**CDM/GS/VCS/JI/SC-TEC,
CDM/VCS/GS -VAL, -VER**

per le seguenti aree tecniche:
for the following technical areas:

1.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation from fossil fuel and biomass including thermal electricity from solar	1

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	09-12-2010	-
8	21-05-2014	Updated qualification according to IS-QPT-GHG-00 REV13

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
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RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Rita Valoroso

è qualificato come1:
is qualified as:

CDM/VCS/GS/SCS/JI – TEC
CDM/VCS/GS/SCS – VAL, VER, TL
TECHNICAL REVIEWER

per le seguenti aree tecniche:
for the following technical areas:

1.2, 13.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Energy generation from renewable Energy sources	1
13.1	Waste Handling and Disposal	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	18-01-10	-
8	31-07-14	Update qualification according to IS-QPT-GHG-00 REV13

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS : Verified Carbon Standard:
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

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RINA

**CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE**

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Ramani Venkatarama

è qualificato come¹:
is qualified as:

CDM/VCS/JI/GS/SCS-TEC

per le seguenti aree tecniche:
for the following technical areas:

5.1, 11.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
5.1	Chemical process industries	5
11.1	Chemical process industries	11

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	06/08/2012	-
2	13/06/2014	Update qualification according to IS-QPT-GHG-00 REV13

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS : Verified Carbon Standard:
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports