VERIFICATION AND CERTIFICATION REPORT

FUEL WOOD SAVING WITH IMPROVED COOKSTOVES IN CAMBODIA,

VOLUNTARY CARBON UNIT VERIFICATION

MONITORING AND REPORTING PERIOD:
MAY 10, 2003 – JANUARY 9, 2007

REPORT NO. 2007-1007
REVISION NO. 01

DET NORSKE VERITAS

VERIFICATION AND CERTIFICATION REPORT

Date of first issue: 2006-03-26	Project No.: 92071007
Approved by: Einar Telnes Director	Organisational unit: DNV Certification, International Climate Change Services
Client: GERES Cambodia	Client ref.: Mr. Minh Cuong LE QUAN

DET NORSKE VERITAS AS

DNV Certification

Veritasveien 1,
1322 HØVIK, Norway
Tel: +47 67 57 99 00
Fax: +47 67 57 99 11
http://www.dnv.com
Org. No: NO 945 748 931 MVA

Summary:

Det Norske Veritas Certification AS (DNV) has been contracted by GERES Cambodia to carry out verification and certification of emission reductions reported for the "Fuel Wood Saving with Improved Cookstoves in Cambodia" (the project) for the period May 10, 2003 – January 9, 2007.

In our opinion, the project's reported GHG emission reductions for the period from May 10, 2003 – January 9, 2007, as reported in the monitoring report (version 06 of 24 April 2007), operational records from the project assessed on site and subsequent operational records submitted in the period after the site audit, are fairly stated.

The GHG emission reductions were calculated correctly based on "Voluntary Emission Reductions : Improved Efficiency in Use of Non-Renewable Biomass", and the revised Project Design Document (version 6 dated April 25, 2007). This documentation has been reviewed and found to be satisfactory. Det Norske Veritas Certification AS is therefore able to certify that the emission reductions reported from the project during the period May 10, 2003 – January 9, 2007 amount to 182 402 tonnes of CO_2 equivalent.

Report No.: 2007-1007	Subject Group: Environment	
Report title: Fuel Wood Saving with Improved Cookstoves in Cambodia, VCU certification.		
Work carried out by: Einar Telnes, Lai Chee Keong		
Work verified by: Michael Lehmann		
Date of this revision: 2007-06-07	Rev. No.: 01	Number of pages: 13

Indexing terms

Key words Climate Change Kyoto Protocol Verification Clean Development Mechanism	Service Area Verification Market Sector General Industry

☒ No distribution without permission from the client or responsible organisational unit

☐ free distribution within DNV after 3 years

☐ Strictly confidential

☐ Unrestricted distribution

Table of Content *Page*

Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction(s)
CFSP	Cambodian Fuel-wood Saving Project
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
DOE	Designated Operational Entity
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
NLS	New Lao Stove
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
UNFCCC	United Nations Framework Convention for Climate Change
VCUs	Voluntary Carbon Units

1 INTRODUCTION

Det Norske Veritas Certification AS (DNV) has been engaged by GERES Cambodia to verify the greenhouse gas (GHG) emission reductions reported as Voluntary Carbon Units (VCUs) for the "Fuel Wood Saving with Improved Cookstoves in Cambodia" project for the period from May 10, 2003 to January 9, 2007, amounting to 182 402 tonnes of CO_2 equivalent. The breakdown of the GHG emission reductions (VCUs) for the respective periods is as follows:

a. 10 June 2003 – 9 December 2003 (2 822 tCO_2e)
b. 10 December 2003 – 9 December 2004 (21 833 tCO_2e)
c. 10 December 2004 – 9 December 2005 (50 980 tCO_2e)
d. 10 December 2005 – 9 December 2006 (95 880 tCO_2e)
e. 10 December 2006 – 9 January 2007 (10 887 tCO_2e)

The project has applied a methodology stated in "Improved efficiency in use of non-renewable biomass" July 2006 issued by the Climate Care Trust, based on modifications of the yet to be approved CDM methodology AMS II.G proposed by the Joanneum Institute. As this methodology is not an approved methodology for CDM project activities, DNV has nevertheless verified the correct application of it, however not assessed the methodology itself. The emissions reductions are reported in the monitoring and operational records which have been summarised and presented in the monitoring report .

This report contains the findings from this verification assignment and a certification statement for the VCUs.

The verification team consisted of the following personnel:

Einar Telnes	DNV Norway	Team leader
Lai Chee Keong	DNV Malaysia	CDM validator
Michael Lehmann	DNV Norway	Technical reviewer

1.1 Objective

The verification is a periodic independent review and *ex post* determination by a Certification Entity / Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the project activity complying with defined criteria during a defined verification period. The Voluntary Carbon Standard (VCS) of March 2006 /4/ was used as criteria for this verification.

Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

1.2 Scope

The verification scope is:

- to review the PDD of the project as part of the verification and certification process,
- to assess the baseline of the project,
- to assess the additionality of the project as opposed to the baseline scenario,

- to assess that the chosen methodology is applied correctly.
- to review the formulae used in the calculation of the voluntary carbon units to ensure that the assumptions made and default values used are conservative and transparent,
- to review the monitoring plan to ensure completeness and its effectiveness of implementation,
- to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan,
- to evaluate the GHG emission reduction data and express a conclusion with a high level of assurance about whether the reported GHG emission reduction data is free from material misstatement,
- to verify that the reported GHG emission data is sufficiently supported by evidence, i.e. monitoring records.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

The verification team has, based on the recommendations in the Validation and Verification Manual /7/ and employed a risk-based approach, focusing on the identification of significant reporting risks.

1.3 Description of the Project Activity

Title of project activity:	*Fuel Wood Saving with Improved Cook-Stoves in Cambodia*
Project Participants:	*Project developer: GERES Cambodia*
	Project partner: WENETCAM (Wood Energy Network of Cambodia) and DATe (Development and Appropriate Technology)
Location of the project activity:	*The project is located at 9 regions/states/provinces: Phnom Penh, Kandal, Kompong Speu, Prey Veng, Takeo, Siem Reap, Battambang, Kampong Cham and Kompong Chhnang, Cambodia*

The project was initiated as part of the Cambodian Fuel-wood Saving Project (CFSP), which was created to reduce the wood consumption in Cambodia in order to protect its forest resources. There are two phases of the project.

Phase I of the project began in 1997 and ended in 2001. This phase was primarily a set up phase which elaborated stove design, trained producers and developed a distribution network for the New Lao Stove (NLS).

Phase II of the project started in 2002 and was completed in January 2007. Phase II focused on developing the commercialised distribution of the stove design.

The ultimate goal of the project is to facilitate a nationwide shift from inefficient exploitation of fuel wood to sustainable and efficient biomass use.

Apart from avoiding GHG emissions by reduced wood and charcoal combustion, the project also contributes to improvements in a number of areas: Avoidance of overexploitation of the forests;

reduction of airborne particles emission and associated respiratory diseases; time saving in fire wood collection, reduction of purchased fuel costs, transfer of technology to indigenous people and creation of employment opportunities.

2 METHODOLOGY

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project. The DNV team has for this assignment decided to check all factors and issues with the same emphasis, but has also during its preparations identified the key reporting risks and used the assessment to determine to which extent the project operator's control systems were adequate for mitigation of these key reporting risks. In addition, other areas that can have an impact on reported emission reductions have also undergone detailed audit testing. All the monitoring records stated in the methodology of "Improved efficiency in Use of Non-Renewable Biomass" have been examined and verified for the reporting period.

The verification process was guided by a verification checklist, which aims to ensure a transparent verification process. This documents in detail how the factors contributing to emission reductions have been verified and how the verification findings have been reached.

Duration of verification

Preparations:	*March 9-10, 2007*
On-site verification:	*March 19-22, 2007*
Verification of subsequent records*:*	*May 2003 -January 2007*
Draft Report*:*	*March 26-27, 2007*
Final Report:	*May 11, 2007*

2.1 Review of Documentation

The basis for the verification has been the monitoring report from the project for the period May 10, 2003 – January 9, 2007, dated February 21, 2007 and version 6 of monitoring report dated April 24, 2007; monitoring records for the same period; version 5 of the project design document (PDD) dated 12 December 2006; version 6 of PDD dated April 25, 2007 and the applied methodology for the project, Voluntary Emissions Reductions: "Improved Efficiency in Use of Non-Renewable Biomass", July 2006. The project operator has in addition supplied the verification team with instructions from its management system as well as detailed raw data needed for verification of the required emission factors used for the verification period.

The review of documentation includes the verification of the methodology used in the carbon emissions reduction calculation, and assessment of the project baseline and project additonality. The conclusions of this assessment are listed in chapter 3 below.

2.2 Site Visit

Detailed verification of all operational data leading up to the date of the site audit was performed during a visit at GERES Cambodia on March 19-22, 2007. During the site visit, the following personnel were interviewed or assisted the verification team:

Name	Organization
Mr. Minh Cuong LE QUAN	Climate Change Unit of GERES

	Cambodia
Mr. Samuel BRYAN	Climate Change Unit of GERES Cambodia
Mr. HOEUNG Chuntheng	Quality Control Officer of GERES Cambodia
Mr. Iwan BASKORO	Director of GERES/Monitoring Unit Manager
Mr. KAING Samnang	Charcoal Technician
Mr. NGET Long	IEC Officer

These people were also present at the opening and closing meeting of the audit.

2.2.1 Audit Programme

The site visit had the following programme:

March 19, 2007

09:30	Opening meeting
09:30-12:00	Detail checking of baseline estimation
13:00-15:00	Detail checking of daily monitoring records and spreadsheets
15:00-15:15	Meeting with partners MIMIE
15:15-17:00	Continued checking of daily monitoring records and spreadsheets
17:00	End of day 1

March 20, 2007

Time	**Activities**
05:30	Travel
09:00-12:00	Visit to Aural National Forest and other areas affected by charcoal production. En route visit charcoal distribution network.
13:00-15:00	Visit traditional charcoal kilns
15:00	End of day 2

March 21, 2007

Time	**Activities**
06:00	Travel
09:00-12:00	Visit New Loa Stove (NLS) users at the floating community
13:00-15:00	Visit NLS producers, training centre, distributors and wholesalers in Kg. Chhnang
15:00	End of day 3

March 22, 2007

Time	Activities
08:00	Travel
09:00-12:00	Visit small restaurant users, retailers and producers at Phone Penh
13:00-15:30	Preparation for close-out meeting
15:30	Close-out meeting
16:00	End of day 4

3 VERIFICATION FINDINGS

Findings established during the verification may be that:

i) the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified;

ii) the verification has identified material misstatements in the reported emission reductions. Emission reductions with material misstatements shall be discounted based on the verifier's ex-post determination of the achieved emission reductions.

A forward action requests (FAR) may be issued, where:

- the actual project monitoring and reporting practices require attention and /or adjustment for the next consecutive verification period, or
- an adjustment of the monitoring plan is recommended.

In the context of FARs, risks may be identified, which may endanger the delivery of emission reductions in the future, i.e. by deviations from good reporting or management procedures. As a consequence, such aspects should receive a special focus during the next verification.

3.1 Methodology

The methodology chose for the emission reduction calculation was based on the "Voluntary Emission Reductions - Improved Efficiency in Use of Non-Renewable Biomass" developed by the Climate Care Trust, derived from CDM methodology AMSII.G., and amended by the Joanneum Institute and approved by the community of practice (HEDON, Stove and Carbon Special).

The methodology chosen is presently not an approved CDM methodology, but its application is justified to be the best available methodology at the time of PDD preparation.

The methodology has been reviewed and found to be capable of conservatively estimate the carbon emissions reductions. The methodology has included a 15% of leakage reduction, which was deemed to be conservative, and in line with CDM methodologies that also apply the same 15% discount factor where the leakage is hard to assess.

3.2 Baseline

The principle causes of deforestation in Cambodia are agriculture, shifting cultivation, fuelwood harvesting and logging.

Various literatures have been reviewed and summarised in the monitoring report and the PDD. The literature reviews cover the forest covers from pre 1970s to current and future estimated rate of deforestation. It was reported that based on study conducted by FAO in 1977 that pre 1970s forest cover was estimated as being 13 227 100 ha or 73% of the total land area. By 1996 the forest cover was estimated from satellite imagery to be as low as 10 535 763 ha or 58 percent of the total land area.

Charcoal is mainly used in urban areas or towns, especially in Phnom Penh, the capital of the country. According to the National Statistics Institute, in 1997, 59% of the total wood energy was used in Phnom Penh. Various studies have been made reference in the PDD that the supply of wood used as direct energy source or in charcoal making is not sustainable as the usage is greater the re-growth of fuel wood trees. A study from FAO carried out in 2001 reveals that sustainable use of fuelwood through re-growth is just 4% of the total demand per year.

Based on the field survey carried out by the project proponent, 90% of the Cambodian rely on fuelwood for cooking. In the absence of the project, the demand for fuelwood would continue to grow and it would deplete the forest in a faster rate and the fuelwood supply is and will not be sustainable.

The baseline calculation has been estimated in accordance the methodology chosen. The calculation of baseline is deemed to be conservative and transparent.

3.3 Additionality

The improved cook stoves as descibed in the PDD emit less airborne particles, which improves the living conditions of the users. In addition, the disbursement of more efficient cook stoves is narrowing the gap between the rising fuel wood needs of a growing population and the diminishing forest resources.

The main purpose of the project is to reduce the consumption of firewood with the improved design of cooking stoves with better combustion efficiency and insulation to prevent heat from escaping. There are millions of families relying on firewood and charcoal for daily cooking. The improved cookstove will be able to reduce the consumption of charcoal and firewood. In the absence of the project, the rate of firewood chopping for cooking or charcoal making would continue.

The reference made in the PDD entitled "Wood Energy Baseline Study for CDM in Cambodia" (E.R. VAN MANSVELT, CCCO-IGES 2006) concludes that the potential wood left in the area

could never supply total wood demand for charcoal, estimated at 369.000 ton per year, which is resulting in the clear-cutting of at least 45 km2 per year of deciduous forest. This analysis concludes that the current charcoal production practices are not sustainable. The natural regeneration of forests is far too slow to produce enough fuelwood to cover the demand. The conclusion was further substantiated with findings from a study carried out by the World Bank. This concluded that the natural forests of Cambodia, host to immense biodiversity kept on reducing by 3%/year since the 1990s, or an average loss of 197,000 ha per year from 1995-2005.

The project was supported with the above field surveys and further research on the additional impact of NLS in the fire wood and charcoal saving. This assessment concluded positively on project additionality.

Prior to the implementation of the project, the new technology was not required by any law or regulation, it was in no way representing common practice in Cambodia, nor was it representing the least cost option for cooking. Hence, the project can be considered additional under the VCS version 1 additionality criteria.

3.4 Assessment

The data presented in the monitoring report and monitoring and operational records for the entire verification period were assessed in detail by review of the detailed project documentation and production records, interviews with personnel of GERES Cambodia, relevant NLS producers, retailers and end users, collection of measurements, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of reported monitoring results and verify the correct application of the monitoring methodology.

Following the site visit and submission of additional information, monitoring and operational records for the entire verification period were assessed for the period May 10 2003 – January 9, 2007. Reconsolidation of all reported data was performed, based on a final assessment of monitoring and operational records from the period subsequent to the audit.

3.4.1 Factors used for project emission reduction calculations

All reported factors required by monitoring methodology of “Improved Efficiency in Use of Non-Renewable Biomass”, July 2006, the parameters required for monitoring given in the PDD as well as necessary management system issues were also assessed during the site visit. This included the following:

Ex-ante parameters:

a. Equipment ratio per family;

b. Fuel saving test (laboratory and actual testing);

c. Wood to charcoal conversion;

d. Stove lifespan;

e. NCV of biomass;

f. $EFCO_2$, biomass;

Ex-post parameters:

a. Sales of New Lao Stoves to distributors and

b. Stoves produced by respective producers.

3.4.2 Monitored date for project emissions within the project boundary

The flowing data reported in the monitoring report from the project has been assessed in detail. When nothing else is stated, the numbers reported are found to be correctly reported.

1. Quantity of New Loa Stoves sold

This amount is reported on a routine basis when the complete NLS is produced. The total quantity of each stove type (7 types) produced is summed-up on a monthly basis. This data is collected by the monitoring staff and in turn keyed into the spreadsheet for calculation.

2. Quantity of New Loa Stove replaced (NLS lifespan)

The estimated lifespan of New Lao stove (NLS) is three years. No actual data was available from domestic stove users. An estimation of stove lifespan was conducted with small restaurant users. This group is classified as the heavy users. From the field survey conducted on all the restaurant users, it was reported that the average lifespan of a stove is 4195.87 hours. The average stove usage of the domestic users was reported to be an average of 3.5 hours/day. The division of total lifespan of stove by the average usage would give a close estimation of 3.28 years for stoves used in homes. The project has thus selected a 3 years the lifespan of a NLS (determined ex-ante).

3. Quantity of stoves in use:

The difference between quantity of stoves sold and stoves replaced is the quantity of stoves in use. The quantity of stoves sold is the total number of NLS sold by all the producers to distributors. An additional field survey has been conducted after the initial verification site visit; a statistically robust Point of Sale Time (POST) analysis has been used to estimate that the time taken from the distributor to reach the end-user is 25.2 days. 30 days has been adopted by the project proponent in the calculations to ensure the conservativeness of the calculations. The replacement of stoves is currently anticipated to be three years, the estimated lifespan of stoves. The number of stoves sold 36 months ago would have to be deducted from the quantity of stoves sold on the 37th months. No deduction is performed for the first 36 months as the project assumed that all the stoves sold are still in use.

3.5 Project Implementation

The project is implemented and has been in operation since May 10, 2003, when the commercial manufacturing, distribution and sales of NLS commenced. The project started the management and monitoring of quantity produced by the producers and the quantity of NLS sold to the distributors as input to a Voluntary Carbon Standard project since May 10, 2003.

3.6 Completeness of Monitoring

The monitoring of the project is comprehensive and in accordance with the approved monitoring methodology. The monitoring methodologies and sustaining records were sufficient to enable

verification of emission reductions. Majority of the factors used are either adopted from IPCC or project specific data. All the parameters needed for emission reduction calculations were sufficiently monitored.

3.7 Accuracy of Emission Reduction Calculations

The formula used for the emission reduction calculations was found to be accurate. However, some of the assumptions made in version 5 of PDD were in need of further justification. The following assumptions were made/implied in the calculations, and they have been substantiated with evidence from the project proponent to confirm that the assumptions made in the calculations are fair and conservative.

The following parameters (ex-ante) have be reviewed and revised to ensure conservativeness of assumptions:

a. Quantity of NLS sold

   The quantity of NLS sold in each monitoring period (monthly) is used in the emission reduction calculations. A FAR was raised as the NLS purchased by distributors are not necessarily being sold to end users. If stoves are not sold to end users, the carbon saving in the calculation may not be real.

   The project proponent has reviewed this FAR using the statistically robust POST analysis, the time between stoves being sold by the producer and utilized by end users, is 25.2 days. It can be asserted with 95% confidence that any given stove will have been sold within 25.2 days of arrival at any given retailer. Combined with an estimated travel time of five days a period of one month is adopted as the average POST for New Lao Stoves.

   The assumption of 1 month has been adopted for the NLS sold to reach the end user. The estimation using a POST analysis was justified and deemed satisfactory.

b. Fuel saving test (laboratory and actual testing)

   The test was carried out both in the laboratory and in the field. The laboratory test involved the “water boiling test” in laboratory utilising both the traditional and new lao stoves to verify the efficiency gained in the NLS. Additionally, 20 selected families were selected in a field test. The selected families were asked to collectively decide on the menu for three meals for a week. The families will then cook the decided menu for three meals using the traditional stove and the new loa stove in the first week and subsequent weeks respectively.

   The underlying assumption in these tests is that the consumers use only two types of stoves (TLS and NLS) and either use charcoal or fire wood only. The observation during the site visit revealed that users have more than these two types of stoves and that mixing of fuel is practiced. The short and fast cooking would normally use firewood which could generate more intense fire. The slow and time consuming cooking such as boiling soup, water and rice would normally utilise charcoal. A FAR was raised to address this mix in more detail.

The project proponent has justified that it is difficult to replicate fuel mix under test conditions so nationwide survey data is used to establish the quantity of wood and charcoal being used, considering the relative proportions of wood and charcoal being used by biomass stoves. Based on the survey of 385 biomass stove users across Cambodia the average mix of charcoal and wood in traditional stoves is 32.12 kg and 37.56 kg a month, respectively. Fuel consumption using NLS is reduced to 25.31 kg/month for charcoal and 29.55 kg per month for fire wood. The respective fuel consumption reduction using NLS was justified satisfactorily considering the challenges in replicating the fuel mix under test conditions.

The dry and wet seasons have been considered in its survey. It was concluded that during dry season there is a higher efficiency for both firewood and charcoal users. The values reported in the PDD and spreadsheets were found to be different in the earlier version, they have now been corrected in version 6 of the PDD.

Values reported in the PDD were the dry season stove efficiency (higher value), 21.76% and 21.49% for charcoal and wood saving when switched to NLS respectively in version of 5 of the PDD. This has now been revised, an average efficiency for both seasons has been adopted to ensure conservativeness. The average efficiency value of charcoal and firewood is 21.2% and 20.89%, respectively.

c. Wood to charcoal conversion

Two conventional charcoal kilns were surveyed. The results obtained were 5.98 and 6.92 kg wood used / kg of charcoal produced. These give an average of 6.45 kg wood/kg charcoal. A FAR was raised as that the result obtained from the two kilns has a difference that requires more kilns to be studied in order to obtain more reliable data.

The project proponent has decided to adopt the IPCC default value of 6 kg of wood per kg of charcoal.

d. Stove lifespan

The survey done in 2006 did not reveal any replacement of NLS in domestic users. In turn, the micro-restaurants classified as the heavy users were studied. It was concluded that the life span of NLS for heavy users is about 4195.87 hours. The average use of NLS by domestic users is 3.5 hours. This would give an estimation of 3.28 years of lifespan. The project has assumed 3.0 years of lifespan.

The assumption of 3 years NLS lifespan was deemed to be conservative. However, a FAR has been raised to request the project proponent to provide evidence to substantiate the assumption as the project has been in operation for more than three years. The project proponent has agreed that before the next verification period, an additional field survey will be conducted to confirm the assumption. This will be verified during the next period of verification and adjustments shall be made should there be any deviation.

e. NCV biomass and $EFCO_2$, biomass

The earlier calculation has utilised default values of IPCC 1996, i.e. NCV biomass and $EFCO_2$, biomass. A FAR was raised to request that the latest IPCC 2006 values to be used. The latest IPCC 2006 values have been used in its emission reduction calculations and relevant spreadsheets have been revised.

The assumption of equipment ratio per family in version 5 of PDD was 1.27. However, the figure has been adjusted to 1.28 based on the recent survey. This is still conservative as the field visit has confirmed that most families have at least two NLS stoves.

Ex-post parameters:

a. Sales of New Loa Stoves to distributors

A delay of one month has been adopted after the sales of stove to distributors before the stoves reach the end users. The calculation of carbon emission reduction in terms of wood and charcoal saving will only be counted one month after the sales of stoves. The survey and statistically robust POST analysis described earlier in the same report was found to be satisfactory. The interviews with the distributors revealed that the movement of stoves if relatively fast and generally distributors do not keep too many stock as the stoves could easily be delivered by the manufacturers. The assumption of one month for the stove to reach the end users from the distributor is thus deemed to be conservative.

b. Stoves produced by respective producers

The quantity of stoves produced by each producer is monitored to check on the overall movement of NLS in the market.

The accuracy of reported emission reductions has been reviewed and revised to ensure fulfilment of the methodology criteria. Additional samples have been taken on May 11, 2007 through sample request (sales of stoves) against the data base entered in the revised spreadsheet.

3.8 Quality of Evidence to Determine Emission Reductions

All necessary documentation is collected, referenced and aggregated and is easily accessible in hard-copy or electronic format. No measuring equipment was involved. Key data can also be cross-checked via other sources, such as stoves produced, sales and inventory data. Some assumptions made have to be further justified to ensure conservative estimation or calculation of carbon emission reductions.

3.9 Management System and Quality Assurance

The GERES Cambodia has applied some management system to the fire wood and charcoal saving project. Relevant monitoring and measurement procedures have been documented and relevant employees have been trained to ensure stipulated procedures are adhered to.

The quality assurance of data management has been improved with sufficient checking after each entry on a monthly basis and approved data will be password protected to prevent any unintended edition.

4 CERTIFICATION STATEMENT

Introduction

Det Norske Veritas Certification AS (DNV) has been engaged by GERES Cambodia to verify the greenhouse gas (GHG) emission reductions reported as Voluntary Carbon Units (VCUs) for the project "Fuel Wood Saving with Improved Cook-Stoves in Cambodia" for the period from May 10, 2003 to January 9, 2007 amount to 182 402 tonnes of CO_2 equivalent.

The GHG emission reductions were calculated correctly based on "Voluntary Emission Reductions : Improved Efficiency in Use of Non-Renewable Biomass", and emissions reductions are reported in the monitoring and operational records.

Responsibilities of GERES Cambodia and Det Norske Veritas Certification AS

The management of the project is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out in the Voluntary Carbon Standard (version 1, March 2006). The development and maintenance of records and reporting procedures including the calculation and determination of GHG emission reductions from the project and the above stated adjustments are the responsibility of the management of the project.

It is DNV's responsibility to express an independent verification statement on the reported GHG emission reductions from the project for the period from May 10, 2003 to January 9, 2007 based on the verified emissions reductions for the same period and the project's compliance with Voluntary Carbon Standard, version 1.

Basis of GHG verification opinion

Our verification approach was based on the requirements and criteria stipulated in the VCS draft version 1, March 2006 and "Voluntary Emission Reductions: Improved Efficiency in Use of Non-Renewable Biomass".

Our verification approach draws on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate them. Our examination includes assessment of evidence relevant to the amounts and disclosures in relation to the project's GHG emission reductions for the period from May 10, 2003 to January 9, 2007.

We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the amount of GHG emission reductions for the period from May 10, 2003 to January 9, 2007 are fairly stated and are additional to what would otherwise have occurred.

The verification included:

- *collection of evidence supporting the reported data,*
- *checking whether the provisions of the monitoring methodology stated in "Voluntary Emission Reductions: Improved Efficiency in Use of Non-Renewable Biomass" and the monitoring plan in the PDD were consistently and appropriately applied.*

We have verified whether the information included in the monitoring and operational records for the project in the stated period is correct and that the emissions reductions achieved have been correctly determined.

Certification Statement

In our opinion, the GHG emission reductions reported from the projectstarting from May 10, 2003 to January 9, 2007 are fairly stated and additional to what would otherwise have occurred.

Hence, Det Norske Veritas Certification AS is able to certify that the reported emission reductions from the project during the period May 10, 2003 to January 9, 2007 amount to 182 402 (One hundred and eighty two thousand four hundred and two) tonnes of CO_2 equivalent.

Oslo, 07-06-2007	Kuala Lumpur, 07-06-2007
Einar Telnes	Lai Chee Keong
Director, International Climate Change Services	Manager, Climate Change Services South East Asia

REFERENCES

Documents provided by the project participants that relate directly to the project:

/1/ Monitoring Report: Fuel Wood Saving with Improved Cookstoves in Cambodia, 10 May 2003 – 9 January 2007 dated February 21, 2007 and version 6 dated 24 April 2007

/2/ Project Design Document: Fuel Wood Saving with Improved Cookstoves in Cambodia. Version 5.0 of 12 December 2006 and version 6.0 of 25 April 2007.

/3/ Additional data: Project Spreadsheet, Producers' production and sales data.

Background documents related to the design and/or methodologies employed in the design or other reference documents:

/4/ Voluntary Carbon Standard, version 1, March 2006.

/5/ Voluntary Emission Reductions methodology: "Improved efficiency in use of non-renewable biomass" July 2006, Climate Care Trust. http://cdm.unfccc.int/UserManagement/FileStorage/RX9G3AESH7GO0QVR07CI0DV0AJ02VY

/6/ Production and Sales Reports (daily), May 2003 – January 2007.

/7/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF): *Validation and Verification Manual*. http://www.vvmanual.info.

- o0o -

APPENDIX A

Table 1: Data Management System/Controls

The project operator's data management system/controls are assessed to identify reporting risks and to assess the data management system's/control's ability to mitigate reporting risks.

The GHG data management system/controls are assessed against the expectations detailed in the table. A score is assigned as follows:

- Full - all best-practice expectations are implemented.
- Partial - a proportion of the best practice expectations is implemented
- Limited - this should be given if little or none of the system component is in place.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests*)
A. Defined organisational structure, responsibilities and competencies		
A.1. Position and roles *Position and role of each person in the GHG data management process is clearly defined and implemented, from raw data generation to submission of the final data. Accountability of senior management must also be demonstrated.*	Full	It was well understood by the personnel. The roles and responsibilities of all personnel involved in the GHG data management have been documented and included in the revised PDD, version 6 dated April 25, 2007.
A.2. Responsibilities *Specific monitoring and reporting tasks and responsibilities are included in job descriptions or special instructions for employees.*	Full	Specific monitoring and reporting tasks are communicated, understood and accepted by relevant employees. These responsibilities have been documented.
A.3. *Competencies needed* *Competencies needed for each aspect of the GHG determination process are analysed. Personnel competencies are assessed and training programme implemented as required.*	Full	Competencies of the personnel in charge of monitoring and calculation process are deemed sufficient. These personnel have been involved in the project since the beginning of the project and they are highly motivated.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests*)
B. Conformance with monitoring plan		
B.1. Reporting procedures *Reporting procedures should reflect the monitoring plan content. Where deviations from the monitoring plan occur, the impact of this on the data is estimated and the reasons justified.*	Full	No changes were identified to the monitoring procedures.
B.2. Necessary Changes *Necessary changes to the monitoring plan are identified and changes are integrated in local procedures as necessary.*	Full	No changes were identified to the monitoring plan.
C. Application of GHG determination methods		
C.1. Methods used *There are documented description of the methods used to determine GHG emissions and justification for the chosen methods. If applicable, procedures for capturing emissions from non-routine or exceptional events are in place and implemented.*	Full	Integral part of the methods used to determine GHG emissions are documented properly.
C.2. Information/process flow *An information/process flow diagram, describing the entire process from raw data to reported totals is developed.*	Full	An information/process flow are defined and understood by the personnel concerned.
C.3. Data transfer *Where data is transferred between or within systems/spreadsheets, the method of transfer (automatic/manual) is highlighted - automatic links/updates are implemented where possible. All assumptions and the references to original data sources are documented.*	Full	Some minor mistake of data manual transfer was found during the initial verification site visit. Detail checking has been carried out by the project proponent and errors have been corrected. The overall management of data collection, entry into database and calculate of carbon emission reductions have now been documented. Once the data has been checked, the data will be password protected to prevent any unintended edition. Reconciliation of data has been carried out and further verification samples have been taken, no error was detected.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests*)
C.4. Data trails *Requirements for documented data trails are defined and implemented and all documentation are physically available.*	Full	All necessary raw/intermediate data is now kept and maintained in the Phnom Penh office. A copy of the raw/filed data has been kept and maintained in a safe manner in the Phnom Penh office. Non-routine event has been recorded and maintained properly.
D. Identification and maintenance of key process parameters		
D.1. Identification of key parameters *The key physical process parameters that are critical for the determination of GHG emissions (e.g. meters, sampling methods) are identified.*	Full	The key physical parameters are identified.
D.2. Calibration/maintenance *Appropriate calibration/maintenance requirements are determined.*	N/A	No measuring equipment is involved in the monitoring and measurement of the parameters.
E. GHG Calculations		
E.1. Use of estimates and default data *Where estimates or default data are used, these are validated and periodically evaluated to ensure their ongoing appropriateness and accuracy, particularly following changes to circumstances, equipment etc. The validation and periodic evaluation of this is documented.*	Full	$NCV_{biomass}$ and $EFCO_2$, $_{biomass}$ default value of IPCC 1996 have been utilised in earlier version of PDD and monitoring report. The latest IPCC 2006 values of $NCV_{biomass}$ and $EFCO_2$, $_{biomass}$ have been used in the revised version of PDD (version 6 dated April 25, 2007) and monitoring report (version 6 dated April 24, 2007). Fuel saving ratio, wood to charcoal conversion and stove lifespan were estimated based on field survey and in-house research. These estimates have been improved based on the FAR made in section 3.4 of the same report.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests*)
E.2. Guidance on checks and reviews *Guidance is provided on when, where and how checks and reviews are to be carried out, and what evidence needs to be documented. This includes spot checks by a second person not performing the calculations over manual data transfers, changes in assumptions and the overall reliability of the calculation processes.*	Full	Some manual data transfer errors were found during the initial verification site visit.. A documented work flow for data collection, data entry, checking, approving and calculation of carbon emission reductions have been established. The documented work flow was found to be satisfactory.
E.3. Internal verification *Internal verifications include the GHG data management systems, to ensure consistent application of calculation methods.*	Full	The data necessary for calculating GHG emissions and the calculation results have been archived properly. It is fully understood among the relevant personnel.
E.4. Internal validation *Data reported from internal departments should be validated visibly (by signature or electronically) by an employee who is able to assess the accuracy and completeness of the data. Supporting information on the data limitations, problems should also be included in the data trail.*	Full	Raw data used for calculation should be evidently validated. This shall be verified further during the next period of verification.
E.5. Data protection measures *Data protection measures for databases/spreadsheets should be in place (access restrictions and editor rights).*	Full	Validated electronic copies have been protected to prevent any unintended editing. Data protection and back-up procedures have been defined and implemented.
E.6. IT systems *IT systems used for GHG monitoring and reporting should be tested and documented.*	Full	The formulae and default values used in the GHG monitoring and reporting system are now protected. Verified and validated data are protected to prevent any unintended editing. Routine back-up of electronic copies will also be carried out.

Table 2: Detailed audit testing of risk areas and random testing (the FAR raised in the draft report have been retained to ensure transparency of the verification process)

Areas of residual risks	**Additional verification testing performed**	**Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)**
List the residual areas of risks (Table 2 where detailed audit testing is necessary. *In addition, other material areas may be selected for detailed audit testing.*	*The additional verification testing performed is described. Testing may include:* ➢ *Sample cross checking of manual transfers of data* ➢ *Recalculation* ➢ *Spreadsheet 'walk through' to check links and equations* ➢ *Check sampling analysis results* ➢ *Discussions with field engineers who have detailed knowledge of process uncertainty/error bands.*	*Having investigated the residual risks, the conclusions should be noted here. Errors and uncertainties should be highlighted.* *Errors and uncertainty can be due to a number of reasons:* ➢ *Calculation errors. These may be due to inaccurate manual transposition, use of inappropriate emission factors or assumptions etc.* ➢ *Lack of clarity in the monitoring plan. This could lead to inconsistent approaches to calculations or scope of reported data.* ➢ *Technological limitations. There may be inherent uncertainties (error bands) associated with the methods used to measure emissions e.g. use of particular equipment such as meters.* ➢ *Lack of source data. Data for some sources may not be cost effective or practical to collect. This may result in the use of default data which has been derived based on certain assumptions/conditions and which will therefore have varying applicability in different situations.*
Filed Data		
Quantity of NLS sold to distributor ➢ Accuracy of raw data ➢ Manual data transfer to electronic copy	Quantity of NLS sold to distributor ➢ Recording of sales and records retention verified and are OK. ➢ Records of actions taken have been maintained properly.	**Forward Action Request:** The following lapses were found in the checking of data management and carbon emission calculation. <u>Inaccurate data transfer</u> It was found that some of the data collected from field (log sheet) do

Areas of residual risks	Additional verification testing performed	Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)
		not tally with those entered in the electronic copy. Example: Sim Mom and Mok Soy for the period of 10 Aug 2006 – 9 Sept 2006 <u>Missing Data</u> No data was entered into the electronic copy for stove producer Nop Kimso since 10 June 2005, and producer Khen Pum since 9 May 2005. <u>Data protection</u> The current spreadsheets should be protected once checked and approved internally. Both hard and soft copies of data should be archived and retained for the period agreed in the PDD to prevent any unintended damage or editing. <u>Internal Verification and Validation</u> Internal verification and validation should be carried out for (a) raw data collected from field, (b) raw data transferred into electronic copy, (c) emission reduction calculations to ensure accuracy. Relevant corrective action should be taken to prevent future recurrence. <u>Inaccurate assumption</u> The quantity of NLS sold by producers to distributors in each monitoring period (monthly) will be used in the emission reduction calculations. However, the NLS purchased by distributors are not necessarily being sold to end users. If stoves are not sold to end users, the carbon saving in the calculation may not be real. Therefore, the carbon saving due to the saving of fuels (firewood and charcoals) need further justification.

Areas of residual risks	Additional verification testing performed	Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)
Default value and project assumptions		
a) Fuel saving test (laboratory and actual testing)	During site visit, both domestics and micro-business restaurant users have been interviewed on the fuel saving.	The in-house laboratory and field survey has reported a slightly higher value as compared to the default value of 20%. The laboratory and field test methodology is described in chapter 3.4 of the same report. The underlying assumption in these tests is that the consumers are using only two types of stoves (TLS and NLS) and either use charcoal or fire wood only. The observation during the site visit revealed that users have more than these two types of stoves and that mixing of fuel is commonly practiced (using both charcoal and wood at the same time). **Forward Action Request:** Values reported in the PDD were the dry season stove efficiency (higher value), 21.76% and 21.49% for charcoal and wood saving when switched to NLS respectively. It was deemed to be not conservative. The lower value of these values or at least the average efficiency of both seasons should be utilised to ensure conservativeness. Alternatively, the default value of 20% stipulated in the methodology should be used.
b) Wood to charcoal conversion	The overall filed survey data and calculation has been verified during the site visit.	The in-house field survey has reported a slightly higher value as compared to the IPCC default value of 6.0 kg wood per kg charcoal. Two conventional charcoal kilns were surveyed. The results obtained were 5.98 and 6.92 kg wood used /kg of charcoal produced. These give an average of 6.45 kg wood/kg charcoal. **Forward Action Request:** It was felt that the result obtained from the two kilns has a large

Areas of residual risks	Additional verification testing performed	Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)
		difference and more kilns should be studied to obtain a more reliable data. Alternatively, the IPCC default value should be used.
c) Stove lifespan	During the site visit, verifier has visited domestic users in the floating village of Kampung Chhnang and micro-business restaurant in Phnom Penh to verify the estimation of NLS lifespan.	The project has started since May 2003 and the survey done in 2006 did not reveal any replacement of NLS by domestic users. Instead, the micro-restaurants classified as the heavy users were studied. It was concluded that the life span of NLS for heavy users is about 4195.87 hours. The average use of NLS by domestic users is 3.5 hours. This would give an estimation of 3.28 years of lifespan. The project has assumed 3.0 years of lifespan. **Forward Action Request:** As the project has started for more than three years now, it would be possible and beneficial to confirm the assumption made on the average lifespan of a NLS, i.e. ex-post monitoring. It would be part of the monitoring parameter identified as R3 in the PDD.
Ex-post Monitoring		
Monitoring parameters of R1 until R6 and R8.	R7 is not monitored as the project has adopted a 15% reduction from its overall carbon emission.	**Forward Action Request:** The PP should review and revise the current monitoring plan to ensure full compliance to the required of the approved methodology used. The indicator of each parameter including the method, frequency of monitoring should be determined and implemented. Example: It is not sure how the project proponent verify that the replaced low efficiency appliances are not used within the boundary (R5) etc.

- o0o -