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**FINAL report**

**Project**

**"Promotion of cleaner industrial  
Production in the kingdom of Cambodia"**

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**US/CMD/03/048**

**Submitted to: United Nations Industrial Development Organization(UNIDO)**

**By: VietNam Cleaner Production Center**

**Date: 30 October 2006**

## **Abbreviations**

CP	Cleaner Production
CPA	Cleaner Production Assessment
BAT	Best Available Technology
VNCPC	Viet Nam Cleaner Production Center

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## **I INTRODUCTION**

This report summarize results of the project named" **Promotion of Cleaner Production in the Kingdom of Cambodia**" that taken place in 2005.

The project will assist the government of Cambodia to improve the productivity and competitiveness of its growing industry base, as well as improve industry's access to international and more local markets, through the application by export-oriented enterprises of cleaner production techniques and technology. Activities will focus on building national capacity in cleaner production through awareness-raising, conduction of in-plant demonstrations at se and running of training programs. As indicated in the project document as well as confirmed in the inception report, the project consists of 2 main activities: cleaner production training for and in-plant demonstration at selected textile companies.

## **II. RESULTS FROM THE PROGRAM**

### **2.1 Training Activities**

In order to sustain the CP in the participating companies after the program completed, the training modules on cleaner production assessment methodology were held for representatives from enterprises of textile sector, demonstration companies, from provinces, related Ministries and Departments and Academic institutions, national consultants. Through the training, the program had tried to build-up a resource base of national experts on cleaner production. The four training modules were implemented which instruct all steps and specific tasks in systematic CP assessment methodology and related subjects to the trainees of the training.

The above in-depth training was done mainly by Dr. Heinz Luenberger, CTA of the project; Dr. Permod Gupta, Director of India CPC, CP expert and Ms. Vu Tuong Anh, Deputy Director of VNCPC, CP expert. Besides, Mr. Do Trong Mui, Mr. Nguyen

Thai Hoa and Mr. Bertrand Collignon from VNCPC had participated the training as resource persons.

Addition to the in-depth four modules- training, awareness-raising seminars were organized to introduce the CP concept to a number of enterprises and other stakeholders. In the awareness raising seminars, numbers of CP case study from India and Vietnam were presented by Dr. Permod Gupta and CP experts from VNCPC.

Content of the 4module - training covered all the essential knowledge/information to CP to the trainees. The content of the 4 training modules is presented below:

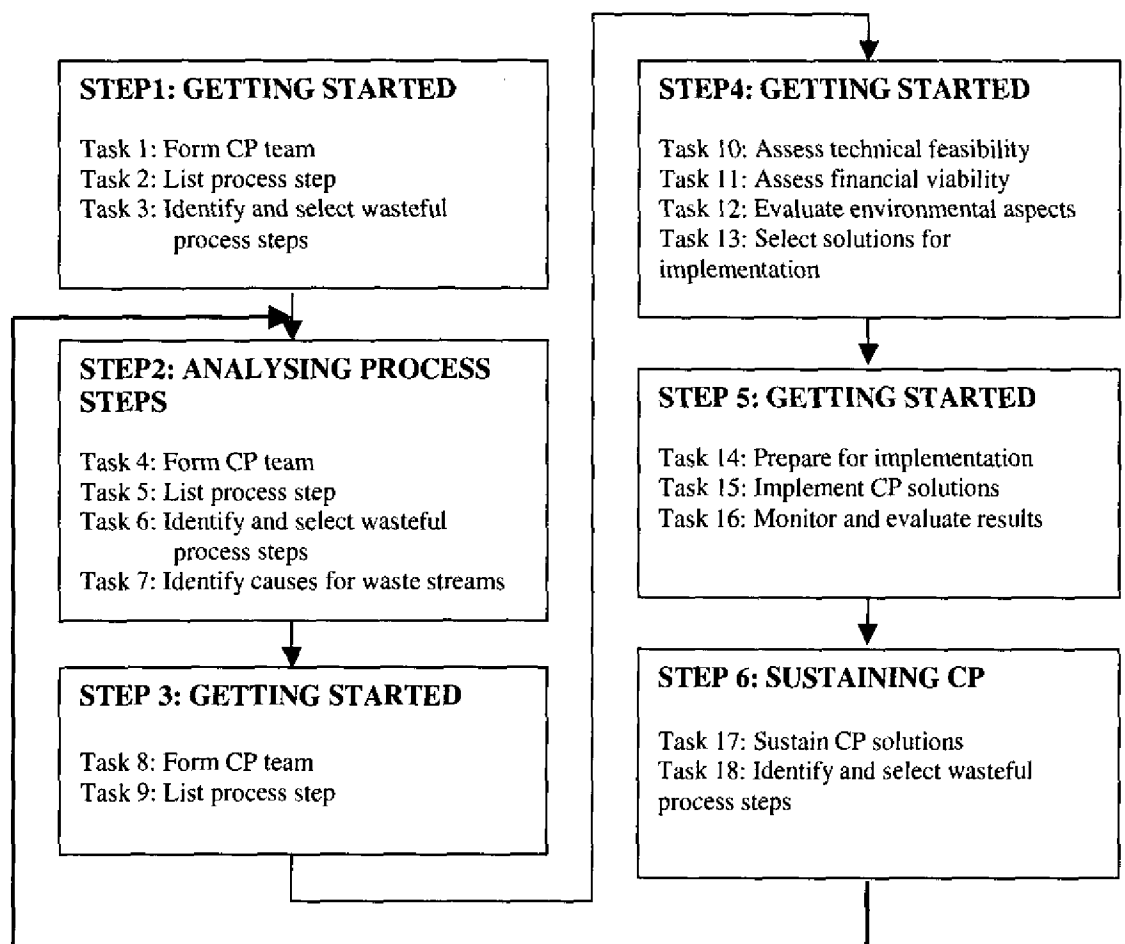
Module 1	Module 2	Module 3	Module 4
<ul style="list-style-type: none"> <li>-CP introduction (concept, benefits)</li> <li>- Detailed CPA methodology (theory and exercises): baseline data collection, selection of CPA focus, develop detailed flow diagram, material balance, energy balance</li> <li>-Wet textile processing</li> <li>Work plan</li> </ul>	<ul style="list-style-type: none"> <li>-Participants present their work</li> <li>-Discussion of results</li> <li>-Identify missing data</li> <li>- CPA methodology (cont.): Assign costs to waste streams; Analyze causes for waste streams; Develop CP options</li> <li>- Energy Efficiency</li> </ul>	<ul style="list-style-type: none"> <li>-Participants present their work</li> <li>-Discussion of results</li> <li>- CPA methodology (cont.): Technical feasibility study; Financial feasibility study, Environmental impacts study</li> <li>-Cleaner technology in textile</li> <li>- BAT in wet textile processing</li> </ul>	<ul style="list-style-type: none"> <li>-Participants present their final draft reports</li> <li>- Discussion of results</li> <li>- Action plan for CP implementation</li> <li>- Related topic to CP: Social responsibility (SR) and Occupational Health and safety (OHS)</li> <li>-CP Investment proposals</li> </ul>

The four training modules have delivered 468 person days of training. See detailed in annex.

After every training module, trainees were asked to evaluate the training. Trainees highly appreciated the quality of the training with the evaluated results were at good level.

## 2.2 In-plant demonstration activity

In-plant assessments at enterprises used as practical training for CPA methodology and using the results for dissemination for CP application in industry. The participating companies were on-job trained the below systematic CP methodology for sustaining CP in their companies



The in-plant assessments were implemented at 4 selected production units named:

1. Suntex Company

2. Wingtai Garment Company
3. Roo-Hsing Company
4. Lotus Pond

Among 4 selected demo units, 3 are foreign invested companies. Therefore, the decisions are made by the owners who are not based in Cambodia resulting in facing difficulties in getting decision related to CP assessments at there production units.

Participants of the training were divided into 4 groups. Each group is in charge in following one demo units. After every in-class training module, an in-plant working visit was done by the assigned group and international experts.

The in-plant assessments consisted of data collection, CPA focus selection, flow diagram preparation, material balance preparation, analyzing causes for waste streams, CP options generation, feasibility analyzing of CP options. There is a lack of baseline data due to there is no monitoring systems at demo units.

The results are all demo units have produced a list of CP options. The number of CP options generated at every demo units was presented below:

Company	Suntex	Roo-Hsing	Wingtai	Lotus Pond
No of CP options	16	18	15	30

The CP implementation has brought not only economical benefits but also environmental ones to the demonstration units.

However, among 4 participating unit, the Win Tai Company and Suntex Garment Company could not be continued have not enough data for final results. Therefore, the detailed results have been got only from Roo Hsing Garment and Lotus Pond Handicraft Company. The benefits from CP implementation are presented below:



*a. Results achieved in Roo Hsing Garment Factory*

<b>Economic benefits</b>	<b>Environmental benefits</b>	<b>Technical benefits</b>
Investment: 630,000USD  Saving:  666,000 USD  Payback: < 1 year	Wastewater volume reduced by 27%  Reduce pollution load in due to consumption chemical reduction  GHG emission reduced by 89%	Reduced electrical energy consumption by 11% and fuel oil by 77%.  Improved product quality  Reduce reprocess rate

*b. Results achieved in Lotus Pond Handicraft Company*

<b>Economic benefits</b>	<b>Environmental benefits</b>	<b>Technical benefits</b>
Investment: Nil  Saving:  Significant but not quantified	Wastewater volume reduced by 50%  Reduce >60% organic pollution load  Gas emission reduced by 50%  Improve working environment	Reduced dyestuff consumption by 60% and wood by 50%.  Improved product quality  Reduce reprocess rate

### **III. FINDINGS AND RECOMMENDATIONS**

#### **3.1 Findings**

1. Model of integration in-class training and in-plant assessment for demo units was found very useful.
2. The in- depth 4 training modules had been well designed, that help participants well understand a circle of CPA and how to do a CPA.
3. The results achieved by the demo units illustrate benefits from CP implementation and it is feasible to Cambodian industries.
4. Generally, companies have less awareness on specific resource consumption losses, environmental effect of production on actual costs of production (total costing including environmental costs). Their monitoring systems of production are very weak. Most of them have no water meter, limited number of electricity meters, and monitoring of material consumption. Then it is a big obstacle for CPA.
5. There is a lack of technical resource at demo companies and a challenge of how to maintain CP in their companies.

#### **3.2 Recommendations**

From the CP program implemented, it is recommended that:

1. The model of integration 4-module in-class training with in-plant assessment demonstration should be applied for the next round of the project, for other industrial sector;
2. It should have more careful, well designed process for selection of demo units that make sure getting real commitment from them;

3. It should not select the companies that owned by foreigner who are not based in Cambodia as demo units;
4. It should have real commitment from the management of the demo unit presented by install proper material and energy consumption monitoring systems.
5. National experts should have more involvement in CPA at demo units to get experiences in carrying out CPA.
6. It should not include the representative from environmental authorities in the CP team. This would lead to have an afraid attitude of the owner in providing real data.

## CONCLUSIONS

The demonstration program on cleaner production at textile sector in Cambodia has achieved the purpose of capacity building in application of CP approach of the program.

It is necessary to expand the number of national experts in CP who can later maintain CP in Cambodian industry.

## ANNEX

### Training time

<b>Module</b>	<b>Time</b>	<b>No of participants</b>	<b>Person. days</b>
<b>Module 1</b>	4-6 April	40	120
<b>Module 2</b>	20-22 June	34	102
<b>Module 3</b>	22-24 August	42	126
<b>Module 4</b>	21-23 November	40	120
<b>Total</b>			<b>468</b>