National Train-the-Trainers Workshop on
Good Practices in Refrigeration

Organised by the
Government of Suriname
in collaboration with the
United Nations Environment Programme

11-14 July 2005
Paramaribo, Suriname
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1. Background
The training of in-country trainers in good practices of refrigeration with a view of establishing regular national professional skill-rising courses with possible regional experience exchanging activities is the vital part of the Refrigerant Management Plan of Suriname. It provides basis for establishing good maintenance practices in refrigeration sector as a widely accepted rule and habit thus preventing substantial leakages and emissions of ODS.

The Technical Department within its Faculty of Technological Sciences of the University of Suriname, NATIN - Nature Technical Institute and the Polytechnic College possess both the necessary expertise as well as the space and the basic equipment to host such training courses during the project and in the follow-up.

There are some 20 refrigeration service workshops registered in Suriname. The total number of technicians essential to be trained is estimated as 200.

2. Objectives
The goal of this training was to reduce use of ODS in refrigeration and air-conditioning sector. The immediate objective is to increase awareness of participants on general issues of ozone depletion and to introduce necessary skills and habits to avoid emission of refrigerant into the atmosphere during the maintenance and repair of the refrigeration and air conditioning equipment.

   Expected results
As a result of this project at least 10% reduction of CFC-12 consumption from 2003 on is to be expected due to prevention of leaks, upgrading system cleaning procedures and using other good maintenance practices by the trained technicians. The trainings will be more effective if linked with certification and licensing procedures and the recovery and recycling programme.

Approach
The project will be organized in three phases

Phase I:    Train the Trainers
The International Consultant possessing the necessary expertise held a 5-day training workshop at the NIMOS (theory) and NATIN (practical). The training included classroom presentations, practical demonstrations in two refrigeration installations and hands-on training session. The necessary demonstration equipment once purchased was used for demonstration purposes of the theoretical concepts explained.

Total number of workshop participants was 32, conformed by professors of the Technical Department, representatives of the Department of environment (attending the general part of training’s) as well as representatives of the key service enterprises. Special attention was given to have appropriate representation of the future trainers from remote districts to ensure the easy coverage of the country at the next stage of the project.

Phase II:  Training of Technicians by Trained Trainers
The trainers will design and deliver hands-on training programs for the technicians throughout the country (Estimated 10 students per training, 20 training’s in total)
Phase III: Monitoring and Control. Certification courses
The Ozone Office will monitor and control the implementation of the training program. If linked with certification the training courses will have continuation and may be established on permanent and self-financing basis.

3.- PRESENTATIONS PROGRAM

Participants information package

1. Documents related to the train-the-trainers workshop
   - Agenda
   - List of participants
   - Evaluation questionnaire

2. Training and background documents
   - Training Manual on Good Practices in Réfrigération
   - Training Manual on Chillers and Réfrigérant Management

Presentations were managed during the training as follows:

1.- History of refrigeration
   Starting from the older times using ice as a cold production through modern refrigeration processes.

2.- Ozone depletion and effects
   CFCs refrigerants It’s effects on the ozone layer and consequences on everyday life on human beings and the Montreal Protocol actions to phase out CFCs.

3.- Refrigerant overview
   A general description on refrigeration systems from domestic, commercial and industrial applications, identifying main components and differences regarding refrigerants used in each case.

4.- Basic concepts
   An overall view of thermodynamic basic concepts, a description of p-h Molliere diagram and the basic refrigeration cycle processes (Including a software program used for many simulations of refrigerants)
   Main components description as compressors, evaporators, condensers, expansion devices, valves and controls.

5.- Superheat and subcooling
   Advantages and disadvantages on superheat and subcooling refrigeration systems and considerations when new refrigerants are being used.

6.- General good practices in refrigeration
Regarding the principles of operation refrigeration systems we focussed on CFCs phasing out and new refrigerants and oil trends, saving energy concepts and implementation actions to assure a reliable and permanent operation.

7.- Chillers and refrigerant management
Chiller: a refrigeration system mainly used in industrial applications processes and air conditioning systems for confort.
Training procedure was focused on identifying different types of applications as Reciprocating, screw, centrifugal and scroll compressors.
Retrofit vs. replacement costs payback calculation
Representative cost of conversions vs. replacement
Typical retrofit performance changes.

Refrigerant Management Plan
Starting with elements of a refrigerant management plan, policy and procedure Statements.
Refrigerant containment plan and finally equipment retrofit/replacement strategy.

8.- Recovery recycling and reclaim alternative refrigerants
A technical description regarding different technologies for phasing out CFCs going through HCFCs and HFCs alternatives, costs and consequences.

9.- Hydrocarbons technology
Analysis of a new technology regarding refrigerant and foam uses, we identified advantages and disadvantages, focusing mainly on safety, costs and ecological concepts.

4.- EVALUATIONS
Regarding the requirement to identify the state of knowledge gained of the participants during the training, an evaluation was carried on according to the NATIONAL TRAINING ON GOOD PRACTICESI REFRIGERATION book prepared by UNEP.

The results obtained I considere myself acceptable considering that some participants were not so familiar with technical concepts managed during the training, however as we can observe on the reports some of them will be good trainers.

5.- WORKSHOP RECOMMENDATIONS
1. A certification scheme for refrigeration technicians should be considered In the future.
2. Preparation to conform the refrigeration association in Suriname it's highly recommended
3. NIMOS to provide adequate education and awareness raising among technicians, consumers and the general public.
4. Technicians and workshops should provide data on recovered and recycled refrigerant to the NOU.
5. A long-term disposal strategy at regional level to be developed for contaminated refrigerants and vacuum pump oils.

6. Government to provide incentives for individual workshops and service technicians to recover and to recycle refrigerants in order to make R&R profitable.

7. It’s highly recommended the hands on session during the train-the-technicians training implementing program, mainly in two sessions in a refrigeration industry to identify the systems and at the labs of Natin, using the required equipment and tools for the job, promoting participation of the people.

8. Workshop participants to provide contact data of potential candidates for the train-the-technicians training.

9. Industry should have their technicians trained by recognised training institutes or instructors. The trainees should sit a standardised national examination.

10. The training manual is highly recommended to be updated in some chapters regarding the new refrigerants and tools in the market.

11. It’s important to prepare up dated and complete information concerning the MAC issue.

12. Safety equipment and recommendations are important to be managed in order to avoid accidents during implementation of phasing out CFCs.

13. More time would be required in order to handle all aspects of the training, because of different level of technical concepts is observed.

14. The course content was great and most participants established a permanent dialog with the trainer focusing mainly with real experiences.

15. Follow up actions for training technicians must be handled according a program and revised according as planned by NIMOS.

16. Good planning and logistic is highly recommended during preparation of the courses for the technicians.

17. Organization and assistance for the trainer was supported by an excellent NIMOS team and supervised by UNEP’S staff, I considere myself the final result of this workshop was better than expected.
ANNEX I

Agenda

Traîner: Mr. Ruben Marchand Ortega
Réfrigération and Air-conditioning Professor Politecnic Institute of Mexico/ Réfrigération and Air-conditioning Consultant for the Industry.

Monday, 11 July 2005

08:00 Meeting at NIMOS with Cédric Nelom, the traîner and UNEP représentative
10:30 Visit to NATIN for préparation the implémentation hands on session

Tuesday, 12 July 2005

08:00 Registration of participants
09:00 Opening session
   Welcome
   Workshop opening
10:30 Ozone depletion and effects
11:00 Réfrigération overview
13:00 Lunch
14:00 Basic concepts on refrigeration
17:15 Review of the day
17:30 Closure of the day

Wednesday, 13 July 2005  (location : Natin)

08:00 Général good service practices Part 1
13:00 Lunch
14:00 Général good service practices Part 2
17:15 Review of the day
17:30 Closure of the day

Thursday, 14 July 2005

08:00 Good practices in réfrigération continuation
12:00 Evaluation on Good practices on réfrigération
13:00 Lunch
16:00 Visit to SAIL (Réfrigération plant for shrimp handling)
17:30 Closure of the day

Friday, 15 July 2005

08:00 Chillers and Réfrigérant Management
10:00 Visit to building Church for Chiller’s air conditioning identification system.
11:00 Recovery, recycling and reclaim (hands-on session) at NATIN
13:00 Lunch
14:00 Wrap-up session (questions & answers)
15:15 Trainer’s evaluation
15:30 Delivery of certificate of complétion
16:00 Closure of the workshop
# ANNEX II

## List of Participants

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