



Pacific Ozone Depleting Substances (ODS) Project

A close collaboration
between UNEP and the Government of Australia under the Multilateral Fund
Secretariat, SPREP, and the Pacific islands

Report of the Train-the-Trainers Workshop on Good Practices in Refrigeration Nuku'alofa, Kingdom of Tonga

22 - 26 September 2003



Tonga Maritime Polytechnical Institute
Nuku'alofa, Kingdom of Tonga

January 2004

SPREP's Climate Change and Adaptability

Key Result Area III (KRA 3)

**Report on the Train-the-Trainers Workshop
on
Good Practices in Refrigeration
Nuku'alofa, Kingdom of Tonga**

**22 - 26 September 2003
Tonga Maritime Polytechnical Institute
Nuku'alofa, Kingdom of Tonga**

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Acronyms & Terms

CFCs	Chlorofluorocarbons
DTIE	Division of Technology, Industry, and Economics
ExCom	Executive Committee of the Multilateral Fund
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
IRHACE	Institute of Refrigeration Heating and Air-Conditioning Engineers (IRHACE) Industry Training Charitable Trust (Inc.),
MIT	Manukau Institute of Technology
NCAP	National Compliance Action Plan
NCC	National Compliance Centre
ODS	Ozone Depleting Substances
PICs	Pacific Island Countries
ROAP	Regional Office for Asia and the Pacific
SPREP	South Pacific Regional Environment Programme
TMPI	Tonga Maritime Polytechnical Institute
UNEP	United Nations Environment Programme
UNON	United Nations Office at Nairobi
UV-A	Ultraviolet A radiation
UV-B	Ultraviolet B radiation

Acknowledgements

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EXECUTIVE SUMMARY

The train-the-trainers programme on “Good practices in refrigeration” is part of a comprehensive approach to reduce the ODS consumption in the refrigeration servicing sector in the Pacific region. Training programmes in “Good practices in refrigeration” were approved for the eight core countries involved in the “Regional Strategy to Comply with the Montreal Protocol” (The RS) in Pacific Island Countries. The eight countries in the Regional Strategy are the Federated States of Micronesia (FSM), Kiribati, the Marshall Islands, Palau, the Solomon Islands, Tonga, Tuvalu and Vanuatu. The Regional Strategy was approved at the 36th Meeting of the Executive Committee. The South Pacific Regional Environment Programme (SPREP) is responsible for the implementation of the Regional Strategy in the Pacific region, with the assistance and oversight of United Nations Environment Programme Division of Technology, Industry and Economics (UNEP-DTIE) and United Nations Environment Programme Regional Office for Asia and the Pacific (UNEP ROAP).

The train-the-trainers workshop in the Kingdom of Tonga is the sixth training workshop held in the PIC region, as part of the implementation of the RS. The main objective of the training programme is to reduce the CFC consumption in the refrigeration and air-conditioning sector in Tonga and to assist the country to comply with the phase-out schedule for CFCs under the RS and the Montreal Protocol. The trained participants are expected to help train the remaining service technicians in the refrigeration and air-conditioning sector in Tonga.

The long term expected result of the training programme is to enhance good service and technical practices in the refrigeration sector assisting the sector to switch over to non-CFC equipment in a smooth way without causing an unnecessary burden to the consumers. The training programme drew resources from the Department of Environment of the Government of Tonga and the South Pacific Regional Environment Programme (SPREP). The New Zealand Institute of Refrigeration Heating and Air-Conditioning Engineers (IRHACE) Industry Training Charitable Trust (Inc.) provided the trainer for the course.

The Acting Prime Minister of Tonga, the Honourable Clive Edwards opened the workshop on behalf of the Government of Tonga. In his opening address he emphasised the important responsibility of the Government in working closely with the private sector in developing environmentally friendly industries and products in Tonga for the Tongans. He further stressed the health related issues involving green house gases that are found in refrigeration and air conditioning that must be professionally handled by trained technicians and he is most thankful to the organisers of the workshop in Tonga. Although small Pacific Islands play a small role in the increasing global warming, national actions are necessary to protect the people of the country and at the same time fulfil Tonga’s obligations to related international agreements and conventions.

The participants in the workshop were trained on “Good practices in refrigeration” during the course. The participants represented most of the major refrigeration and air-conditioning workshops and ODS users in Tonga.

The workshop, which was held at the Tonga Maritime Polytechnical Institute (TMPI), included lectures on the harmful effects of ozone layer depletion and the resulting increase of UV-A and UV-B radiation, the Montreal Protocol and its Amendments as well as lectures on CFC, HCFC, HFC and non-Fluorocarbon refrigerants, recovery equipment and preventive maintenance practices. Lectures on retrofitting and future technological developments in the refrigeration sector were also included. Hands-on demonstrations with recovery equipment using actual refrigeration units in need of recharge and maintenance were conducted as part of the training workshop. During the sessions, time was allocated to encourage discussion and feedback of the content, technological changes and methodology

used. This was later formally reviewed through an evaluation sheet indicating the acceptance of the methodology and content of the training.

After the successful completion of the workshop, all participants passed a written examination and will receive a participation certificate from IRHACE and the Government of Tonga and a wallet sized card to indicate that they passed the New Zealand “no loss” campaign examination. .

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1 Introduction

Tonga comprises four main island groups and they are from south to north: the Tongatapu group, the Ha'apai group, the Vava'u group, and the Niuaus. Of the 172 named islands with an area of 747 sq. km only 26 are inhabited and nearly 70% of Tonga's population of around 100,000 lives on the island of Tongatapu where the capital, Nuku'alofa, is located. The islands are between and to the south of both Samoa and Fiji. Tonga is the only Pacific Island nation never brought under foreign rule and is still ruled by its hereditary King, HRH Taufa'ahau Tupou IV. The Kingdom is still run as a constitutional monarchy and the King appoints the 12 members of Cabinet.

The GDP in 1996 (the most recently published figure) was estimated to be in the order of US\$240 million. It has declined since 1996, largely as a result of two natural disasters (a drought and a cyclone) in 1998 and price declines in key world market exports of squash, vanilla and fish. Most economic development is concentrated on the island of Tongatapu, although tourist developments also exist on other islands. In particular, there has been development of tourist infrastructure, including lengthening the runway to allow landing of direct flights from overseas on Vava'u. Vava'u has a large natural harbour suitable for yachts. Tourism is a major part of the economy in Tonga, but is not as significant as in other islands, such as Fiji or the Cook Islands. More than half of the population still live a largely subsistence based agriculture life.

There are no manufacturing facilities using any ozone depleting substances.

Tonga has strong trading relations with New Zealand, Australia and Fiji. Almost all imports pass through New Zealand, Australia or Fiji before being sent to Tonga. Therefore the country of origin of imported goods is often reported as being from Fiji or Australia, even when it has come from elsewhere.

Recently there has been an influx into Tonga of ethnic Chinese from various parts of Asia, due to the sale of Tongan passports. The arrival of the Chinese has led to a relatively large range of Chinese made goods in the markets although it is not clear if the origin was Mainland China, Hong Kong or Taiwan. In 1999 these goods included new refrigerators, labelled as containing CFCs, along with a range of electronic goods, such as televisions and other appliances.

Most inhabitants of Tongatapu have electricity in their houses. Domestic refrigerators are relatively common, however, air-conditioners of any kind are rare outside of the up-scale tourist accommodation and office buildings. As with many other countries in the region, the vehicle fleet is dominated by second-hand Japanese vehicles. Most vehicles manufactured before 1995 arrive equipped with ODS based air-conditioning units.

Because Tonga is a small group of islands, with fairly constant trade winds, corrosion from salt air is a problem. Accordingly, steel products such as cars, refrigerators and air-conditioners, suffer from severe corrosion problems. Due to this corrosion problem, the average life of a car in Tonga is only 5 to 10 years. As a result of the influx of cheap but relatively old second-hand vehicles, the disposal of car parts is becoming a major environmental problem.

According to data submitted to the Ozone Secretariat, Tonga must freeze its consumption of CFCs at 1.69 ODP tonnes from 1 July 2000. As its CFC consumption in 2000 was zero, Tonga is in compliance with its obligation under the Montreal Protocol.

2 Background

The most important sector in Pacific Island Countries (PICs) in which ozone depleting substances (ODS) are used is the refrigeration sector. Yet, poor servicing procedures such as flushing and venting can lead to the release of significant quantities of chlorofluorocarbons (CFCs) directly into the atmosphere. Training programmes in “Good practices in refrigeration” and associated training programmes for customs officers were approved for the eight core countries involved in the “Regional Strategy to Comply with the Montreal Protocol in Pacific Island Countries”. The eight countries in the Regional Strategy are the Federated States of Micronesia (FSM), Kiribati, the Marshall Islands, Palau, the Solomon Islands, Tonga, Tuvalu and Vanuatu. The Regional Strategy was approved at the 36th Meeting of the Executive Committee. The South Pacific Regional Environment Programme (SPREP) is responsible for the implementation of the Regional Strategy in the Pacific region, with the assistance and oversight of United Nations Environment Programme Division of Technology, Industry and Economics (UNEP-DTIE) and United Nations Environment Programme Regional Office for Asia and the Pacific (UNEP ROAP).

SPREP has engaged the New Zealand Institute of Refrigeration Heating and Air-Conditioning Engineers (IRHACE) Industry Training Charitable Trust (Inc.) to carry out “Train-the-Trainers” Workshops on “Good practices in refrigeration” in the eight core countries. All of the eight countries have developed and approved individual ODS phase-out strategies known as National Compliance Action Plans (NCAPs). The NCAPs identified the need to train workers in the refrigeration sector to ensure they have the skills to manage the phase-out of CFC refrigerants.

The skills required by the technicians to ensure the phase out is successful and sustainable include:

- The knowledge of how to keep existing equipment functioning by reducing leakage through better maintenance;
- Retrofitting existing equipment to utilise low- or non-ozone depleting refrigerants; and
- The use of recovery and recycling equipment, especially for mobile air-conditioners.

The training workshop in Tonga was the sixth training workshop carried out in the region under the Regional Strategy. The trainer, Mr Mike Dubey, is currently the Senior Refrigeration Lecturer at Manukau Institute of Technology (MIT). MIT is currently the institution in New Zealand responsible for training refrigeration technicians. The equipment required for the training was supplied from New Zealand suppliers, after a competitive tender, and was paid for by funds approved under the strategy for the training.

This training in the PICs has a high priority in the Regional Strategy because of the current, largely unmet, demand in the region for CFCs to service the mobile air-conditioners (MACs) in imported second-hand vehicles. While imports of CFCs remain uncontrolled in PICs, this trade in second-hand vehicles poses a great risk to all countries’ ongoing compliance.

In the commercial refrigeration sector, selection of inappropriate refrigerants and poor maintenance may also increase energy consumption, resulting in unnecessary increases in energy demand.

Good practices are easy to follow methods to achieve an early reduction of the CFC consumption in the refrigeration sector. These “good practices” include activities such as preventive maintenance and inspection, record-keeping, appropriate training, recovery & recycling as well as the safe handling of refrigerants.

It is essential for the CFC users to be able to reduce and subsequently phase-out their consumption in a co-ordinated, planned and cost-effective manner. Containment practices such as recovery and recycling are expected to ease the economic consequences of the phase-out. Therefore, training on “Good practices in refrigeration” and an effective recovery and recycling programme combined with prudent retrofitting and timely replacement are part of the overall phase-out strategy. The training and skills will assist Tonga to meet the phase-out target of 2005 set out in the Regional Strategy and the control measures under the Montreal Protocol such as the freeze in consumption of Annex A CFCs in 1999 and subsequent reductions in 2002, 2005, 2007 and 2010.

Only a few of Tonga’s refrigeration technicians have received any formal training in a technical training centre. The level of experience of the course participants varied from very good to some with very little experience. Most technicians in Tonga learned their trade “on the job”, although one service company “Kool Tonga” has a New Zealand trained manager who is passing on his skills to his tradesmen. There are no training facilities in Tonga that teach practical refrigeration skills and few technicians have the financial resources to travel off-island for advanced training.

3 Objectives

The main objective of this train-the-trainers workshop was to reduce the CFC consumption in the refrigeration and air-conditioning sector in Tonga and to assist the country to comply with the phase-out schedule under the Montreal Protocol by:

- Increasing participants’ awareness about ozone depletion, the Montreal Protocol, the environmental and economic benefits of good servicing practices and refrigerant containment;
- Introducing and demonstrating procedures that eliminate refrigerant emissions during preventive and unscheduled maintenance including recovery and recycling;
- Disseminating information on CFC-free technologies available today and retrofitting of existing equipment;
- Stimulating the development of a network for information sharing throughout the sector; and
- Helping the country to achieve the planned phase-out in a co-ordinated, planned and cost-effective manner, allowing existing CFC equipment to operate until the end of its economic life.

4 Expected Results

The expected long term result of the training programme is to enhance good servicing and business practices in the refrigeration sector, assisting the sector to switch over to non-CFC equipment in a smooth way without causing an unnecessary burden to the consumers. More specifically, the main expected results are the following:

- Training at least one technician from all of the known servicing workshops so that they can train the remaining technicians;
- Raising awareness in the general public regarding the harmful effects of ozone layer depletion through reporting in the media;
- Minimisation and elimination of uncontrolled emissions of ozone depleting refrigerants through better maintenance practices, leak prevention, and CFC recovery and recycling through training of refrigeration service technicians;
- Elimination of venting of CFC during purging and flushing;
- Increased use of non-CFC equipment and technology and non-CFC coolants; and

- Reduction in CFC demand once prudent retrofitting and replacement of refrigeration and air-conditioning equipment begins.

5 Participants

The twelve participants, who attended the full course, were selected by the Department of Environment in consultation with SPREP and the trainer. They included representatives from the major refrigeration and air-conditioning service organisations. The level of experience of students was varied; some were very experienced, yet others very “new”. There were two automotive technicians (including one lecturer from the technical institute). The Project Coordinator, Mr Tukia Sione Lepa, also attended the workshop and contributed to the course evaluation.

The trainer for the workshop was Mr. Mike Dubey of the IRHACE Industry Training Charitable Trust (Inc). Mr Tukia Sione Lepa, the Project Coordinator, Department of Environment, was responsible for the local organisation. The varied age and experience of participants assisted the communication of new technologies to people at all levels within the Tonga work place.

With the exception of the lecturer from the technical institute, most of the tradesmen worked on varied aspects of refrigeration, and air conditioning systems. There is no formal training available in Tonga. One of the larger service companies, Kool Tonga, is sending their technicians to New Zealand for training. They are undertaking the New Zealand Level 4 Certificate in Refrigeration. The Tonga Federation Co-operative also intends to send one person to study under the same scheme.

Opening Statement

The Acting Prime Minister of Tonga, the Honourable Clive Edwards opened the workshop on behalf of the Government of Tonga. In his opening address he emphasised the important responsibility of the Government in working closely with the private sector in developing environmentally friendly industries and products in Tonga for the Tongans. He further stressed the health related issues involving green house gases that are found in refrigeration and air conditioning that must be professionally handled by trained technicians and he is most thankful to the organisers of the workshop in Tonga. Although small Pacific Islands play a small role in the increasing global warming but national actions are necessary to protect the people of the country and at the same time fulfil Tonga’s obligations to related international agreements and conventions.

6 Methodology

Appropriate training on “Good practices in refrigeration” including containment, recovery, recycling, leak detection, repair, preventive maintenance, retrofitting and new technologies is crucial in order to run existing equipment until the end of its economic life. This approach will help reduce the emissions of ODS, and achieve the planned phase-out in a co-ordinated, planned and cost-effective manner. The five-day training was modelled on the train-the-trainers approach, where in a first phase a number of trainers were trained on good practices in refrigeration. However, in this case as there are no training facilities in Tonga, it is expected that workers will pass on their knowledge to their workmates.

The workshop consisted of both theoretical presentations and practical “hands-on” demonstrations.

There will be several years during which CFC and non-CFC based equipment will be operated side by side in Tonga. The training will ensure that the technicians understand the difference and servicing will be done appropriately.

A “Trainer’s Presentation Guide” has been prepared by the IRHACE Industry Training Trust, based on the above training materials and taking into account the specific training needs in Tonga and new technology developments. Along with copies of the course notes, the participants were given copies of the “Air-Conditioning and Refrigeration Industry Refrigerant Selection Guide”. This Australian produced booklet contains extensive information needed to use the new refrigerants.

7 Contents

During the five-day workshop, the participants learned about the importance of protecting the ozone layer and the harmful effect of an increased UV-A and UV-B radiation. The training included information about the related international agreements such as the Montreal Protocol and its amendments and explained the role of UNEP and SPREP in the implementation of such treaties. The lectures also reviewed the basic principles of refrigeration and responded to the question on how to service refrigeration and air-conditioning equipment in order to avoid refrigerant emissions. Alternative refrigerants were also discussed.

In addition, the proper procedures for refrigerant recovery were demonstrated to the participants during the practical portion of the workshop. The processes for recovery and recycling as well as retrofitting practices and standards were only covered in theory. The course also covered preventive maintenance programmes, record-keeping and safety issues. During the hands-on sessions, the participants practised basic refrigeration techniques, such as brazing, the recovery of refrigerants from refrigerators and leak testing using modern leak testing equipment.

After the successful completion of the workshop, all twelve participants passed a written examination based on the “No Loss” programme operating in New Zealand. The participants will receive photo ID cards to indicate that they passed the course. They will all also receive certificates from the IRHACE Industry Training Trust.

The workshop agenda is attached as Annex 11.1.

Subjects Covered

- Ozone Depletion
- Global Warming – Green House Gases
- Basic Refrigeration Cycle
- Refrigerant Flow Controls
- Good practices in refrigeration including leak detection, fault finding and retrofitting
- Refrigerants – Zeotrope, Hydrocarbons, Ammonia, Carbon Dioxide
- Recovery machine – techniques, domestic refrigeration, commercial equipment, Industrial equipment and mobile air-conditioners
- Cylinder filling, testing, discharging
- Safe Work Practices – At all stages throughout the training, safe work practices were encouraged and reinforced.

8 Results, Conclusions, Recommendations and Lessons learned

The objectives of the workshop have been met and the main results are:

- Training of twelve service technicians on “Good practices in refrigeration” including recovery and recycling of refrigerants;
- Distribution of participation certificates to each participant from the IRHACE Industry Training Trust after passing the examination;
- Exchange of information and experiences between the participants and development of a network of personal contacts; and
- Trainer’s Presentation Guide to be used for the further training of technicians.

The following conclusions, recommendations and lessons learned could be drawn from the train-the-trainers workshop:

Participants reported that bulk CFCs will shortly be no longer available in Tonga. Some workshops may have a small quantity of CFC-12 for servicing domestic refrigerators, but most had already begun using “drop-in” service blends to replace CFC-12 in all applications. The use of these blends and their advantages and disadvantages were discussed in detail at the training workshop.

Because of the limited trade with other countries, it is not likely that any more CFCs will be imported into Tonga, although this will remain possible until regulations prohibiting the import are put in place. The importation of pre-charged refrigeration and air conditioning equipment from Asia (mainly China) could be a source of CFCs coming into the country.

Due to the move away from CFCs, it was also made clear to the trainer that there was little opportunity for recovery of significant quantities of these refrigerants, or other gases during servicing. Corrosion of pipes from exposure to sea air is the major reason for failure and accordingly the workshop participants reported there is usually little or no CFC (or other ODS) left in equipment at the time they are called in to carry out servicing.

Environmental issues concerning the disposal of contaminated refrigerants, oil and other used material was also raised in discussions. The trainer advised that the best technique to deal with any recovered CFC-12 is to re-use it to service vehicle air-conditioning as this type of equipment is more tolerant of impurities that might be present in recovered materials.

As has been the case in other PICs, the trainer felt that the need for all technicians in the Pacific to use dry-nitrogen must be emphasised. Some of the workshops reported that they still used refrigerant to blow debris from condensers, partly because there is no supply of nitrogen in the country at present. This practice is unacceptable and should be eliminated everywhere. The Department of Environment may need to assist workshops to obtain supplies of dry-nitrogen.

9 Follow up Action Plan

This training programme is part of the process of implementing the NCAP for Tonga. As such it will be accompanied by other training and policy related activities as defined in the NCAP. These activities will be co-ordinated by the Department of Environment, ensuring the continued and successful phase-out of CFCs in the refrigeration sector. The Department of Environment will establish a control and

monitoring mechanism to ensure that the objectives of the programme are met and will produce follow-up reports on the status of implementation and the achievements of the train-the-technicians programme.

One issue that was unresolved at the end of the course concerned the purchase of equipment to assist with the phase-out of ODS. The Government of Tonga, under the Regional Strategy, has been allocated US\$20,000 for the purchase of “recovery and recycling equipment”. The issue of how best to use these funds was discussed at the workshop. It was the opinion of the participants and the trainer that because of the patterns of ODS usage and type of equipment failure, there was little need for recycling equipment in Tonga. The very small volume of CFC still in circulation did not justify the relatively high cost of dedicated CFC recovery and recycling equipment. The participants discussed this matter at length and instead recommended that the funds be used to purchase new equipment that would help them more effectively maintain and minimise leakage from existing equipment. The participants, with the assistance of the trainer, developed the following indicative list of equipment they thought would be useful:

- Vacuum gauge
- Refrigeration Scale
- Recovery unit and extra cylinders
- Superheat calculation kit
- Gauge manifold for R410A
- Rottenberger flaring kit
- Flare nut spanners
- Electronic leak detectors
- Tube benders (multi + 1/2” + Ratchet)
- Vacuum pump and 3/8” hoses
- Parts catalogues
- Nitrogen (N₂) Regulator
- Possibly one more set of UV Leak detectors for use by all workshops in Tonga.

The participants did not decide if any equipment should be provided at no cost, or at a subsidised price.

The question of types of equipment purchased should be considered by SPREP (to ensure it would be consistent with ExCom guidelines and decisions) as well as by the Government of Tonga. Approval to purchase these would be sought from the Government of Australia. Particular attention would need to be given to the fairness of any distribution of equipment among companies in Tonga.

Due to the perennial problem of “what are they going to do with any contaminated refrigerants, that they recover and accumulate”, the trainer did some research into resolving the problem. Cooking gas cylinders are relatively cheap in the islands, much cheaper than in New Zealand. If an adapter was made to screw into the existing hand shut-off valve to accommodate a 1/4” male flare, these cylinders could be used for both recovery and storage.

10 Evaluation by participants

The evaluation of the programme was carried out on the morning of the last day. The Evaluation Questionnaire and a detailed analysis of the results are available in Annex 11.3. All twelve participants who attended the week’s training, including the Project Coordinator returned evaluation forms. Most answered all questions, although there were some blanks. One question (17 (f)) was missed by most due to a formatting problem on the printed form.

It is clear from the evaluation that the course was highly successful and the course evaluations were consistently very positive. All but one response rated the overall course as “good” and indicated that IRHACE was a good training organisation. Only one response, from a participant in the automotive sector, indicated that the course was “of little use to my work”, although other comments on that response were still highly positive about the course and the trainer.

There were consistent requests in the comments section for additional training, which may be considered by IRHACE using other sources of funding. Many responses specifically requested training overseas in “modern” workshops.

There was only one question which received a lower score than most, which was 17 e) on the “Operation and use of trade specialty tools”. Here six of the responses only scored the course as acceptable. It appears this reflects the concern expressed in several of the written comments about the need for greater practical sessions, which were not possible within the time available.

11 Annexes

11.1 Agenda

DAY 1

Session	Subject	Presentation (PowerPoint or Video)	Duration
8.15 – 8.30		Training Trust Presentation (PP)	self running
8.30 – 10.00	Introduction		
10.15 – 12.00	Basic Refrig Theory	Basic Refrigeration (PP)	14 slides
12.30 – 3.00	Refrigerants & Safety	Refriger (PP)	26 slides
3.15 – 4.30	Basic Refrig Practical Lab # 17A (from notes)	Copper Tube Work Cut & Bend (Vid)	10 min

DAY 2

Session	Subject	Presentation (PowerPoint or Video)	Duration
8.15 – 8.30		Training Trust Presentation (PP)	self running
8.30 – 10.00	Ozone Depletion	Science Presentation (PP) Protecting Ozone the Search... (Vid)	50 slides 10 min
10.15 – 12.00	Montreal Protocol	Montreal Protocol & Where ODS...(PP) Protecting Your Future (Vid)	34 slides 20 min
12.30 – 3.00	Global Warming Basic Refrig Practical	(end of) Science Presentation (PP) cont. Lab # 17A (from notes)	13 slides
3.15 – 4.30	Basic Refrig Practical	cont. Lab # 17A (from notes)	

DAY 3

Session	Subject	Presentation (PowerPoint or Video)	Duration
8.15 – 8.30		Training Trust Presentation (PP)	self running
8.30 – 10.00	Oils & Lubricants	Oils & Lubricants (PP)	35 slides
10.15 – 12.00	Recovery Recovery Practical	Recovery (PP)	16 slides
12.30 – 3.00	Leak Detection	Leaks (PP)	50 slides
3.15 – 4.30	Press Test Evac & Charg	Pressure (PP)	24 slides

DAY 4

Session	Subject	Presentation (PowerPoint or Video)	Duration
8.15 – 8.30		Training Trust Presentation (PP)	self running
8.30 – 10.00	Retrofitting	Retrofit (PP) Refrigerants Change Over Series (Vid)	46 slides 30 mins
10.15 – 12.00	Review of Course to Date Prep for "No-Loss" Exam		
12.30 – 3.00	"No-Loss" Exam		
3.15 – 4.30	TXV & Superheats	Superheats (PP)	46 slides

DAY 5

Session	Subject	Presentation (PowerPoint or Video)	Duration
8.15 – 8.30	Training Trust Presentation		self running
8.30 – 10.00	Mobile Air Conditioning Setting LP/HP & OP Switches		
10.15 – 12.00	Resit "No-Loss" Exam if Required		
12.30 – 3.00	Question Time		
3.15 – 4.30	Discussion		

11.2 List of participants

	Name	Company	Address	Phone/Fax	Email
1	Sione Tukia Lepa	Department of Environment	PO Box 917 Nuku'alofa	Ph (676) 25 050 Fax (676) 25 051	Tlepacs@hotmail.com
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3	Kafo Mafi	Sea Star Fishing Co Ltd	Vuna Road		
4	Tevita T. Vakalahi	Tonga Institute of Science and Technology	PO Box 485, Nuku'alofa	Ph (676) 22 667 Fax (676) 22 334	
5	Sione Valita	Sione Valita Electrical Engineer	Kolofo'ou		
6	'Ofeina Soakai	Ministry of Health	Refrigeration Mechanic	Ph (676) 23 200	
7	'Ofa Latu	Tonga Cooperation Federation	TEF Building Box 1272 Nuku'alofa	Ph (676) 27 177, 23 777 Fax (676) 23202	Ofalatu@yahoo.com
8	Teisila Fahamokioa	Asco Motors (Toyota)	Box 55 Nuku'alofa	Ph (676) 23 500	
9	Suvenia Fe'iloakitau	Kool Tonga Ltd	Box 1810 Small Industries Maufanga	Ph (676) 24 014 Fax (676) 24 010	Kool@kalianet.t o
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13	Moana Sinipata	Sei 'Uhila Co	Maufanga		

11.3 List of Resource personnel

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11.4 Evaluation Questionnaire

Responses to the evaluation questionnaires are summarised in Table 1 and graphically illustrated below.

Results of Course Evaluation for Tonga

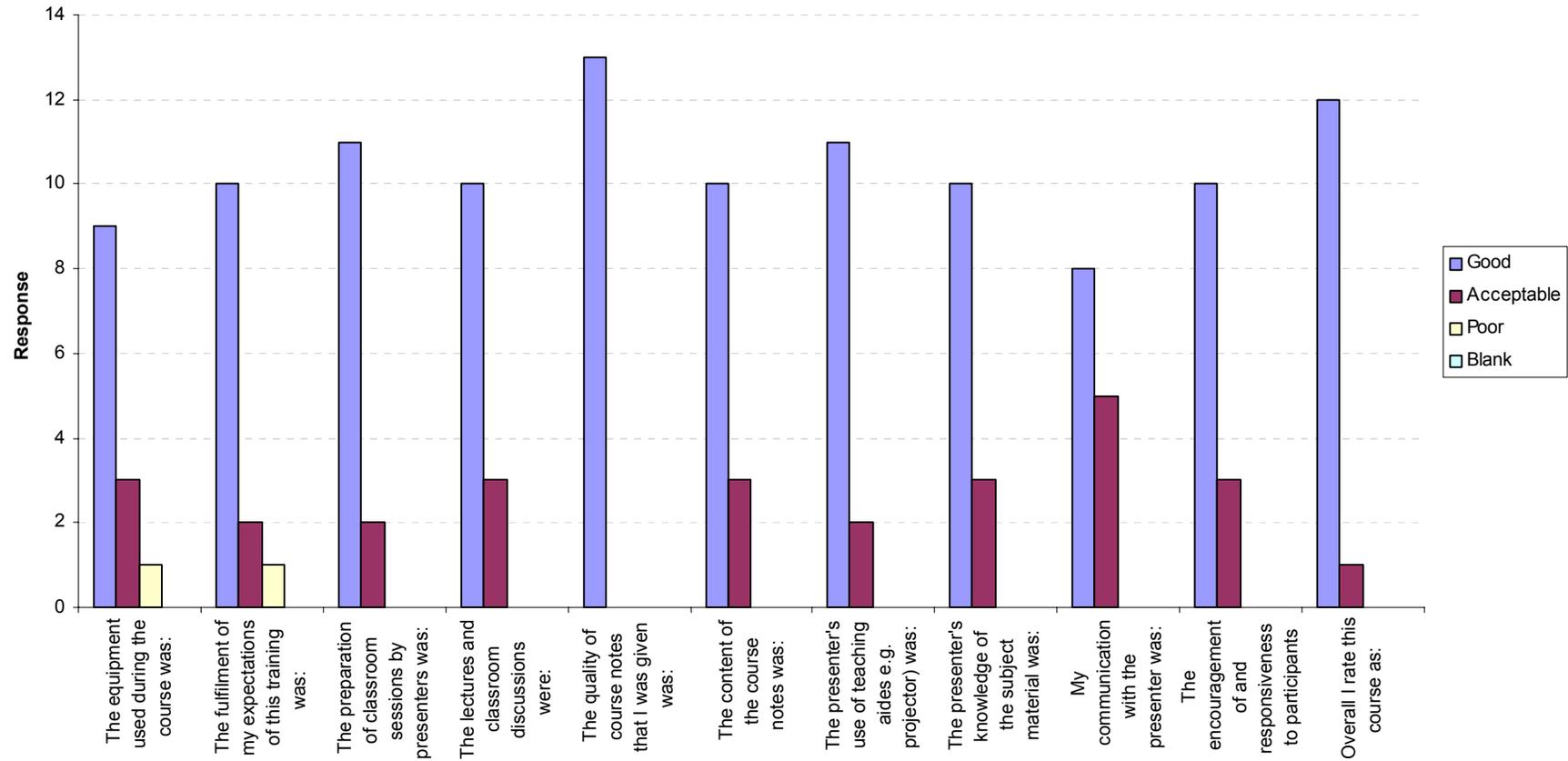


Table 1: Analysis of Evaluation Questionnaires

QUESTIONS/RESPONSES		Weighted average	Good	Acceptable	Poor	Blank
Question 1.	The equipment used during the course was:	87%	9	3	1	
Question 2.	The fulfilment of my expectations of this training was:	90%	10	2	1	
Question 3.	The preparation of classroom sessions by presenters was:	95%	11	2		
Question 4.	The lectures and classroom discussions were:	92%	10	3		
Question 5.	The quality of course notes that I was given was:	100%	13			
Question 6.	The content of the course notes was:	92%	10	3		
Question 7.	The presenter's use of teaching aides e.g. projector) was:	95%	11	2		
Question 8.	The presenter's knowledge of the subject material was:	92%	10	3		
Question 9.	My communication with the presenter was:	87%	8	5		
Question 10.	The encouragement of and responsiveness to participants questions was generally:	92%	10	3		
Question 11.	Overall I rate this course as:	97%	12	1		
Question 12.	The amount of material covered during the course was:	Too Much	About Right	Too Little		
		2	9	2		
Question 13.	I regard this course as:	Very valuable for my work	Definitely useful for my work	Somewhat useful for my work	Of little use for my work	
		9	3		1	
Question 14.	Overall, how would you rate IRHACE Training Trust as a training organisation:	Weighted Average	Good	Satisfactory	Poor	
		97%	12	1		
		Weighted average	Good	Acceptable	Poor	Blank
Question 15.	Did the course provide the	90%	9	4		

	information you expected					
Question 16.	Was the communication between participants possible and useful	90%	9	4		
Question 17.	As far as the contents of the presentation are concerned did you find them adequate in explaining:					
	a) Environmental issues	95%	11	2		
	b) Basic principals of refrigeration	97%	12	1		
	c) CFC/HCFC/HFC/HC refrigerants and technologies	86%	9.5	2.5		
	d) General trade safety	94%	10.5	2.5		
	e) Operation and use of trade specialty tools	83%	6.5	6.5		
	f) Operation and use of passive and active recovery devices	62%	8			5
	g) Good refrigeration practices	92%	10	3		
	h) Retrofitting to alternative refrigerants	90%	9	4		
	i) Creating preventive maintenance programs and record-keeping	90%	9	4		
Question 18.	Has the recovery issue been adequately dealt with in the practical hands-on sessions	97%	12	1		
Question 19.	Did the training course provide you with the relevant information regarding the train-the-technicians phase to be carried out by yourself in your country (please indicate whether additional material could be useful)	87%	10	2		1

In order to summarise the responses, a weighted average has been used. A response of “Good” was given three points, “acceptable” two and “poor” one. Blank responses were given zero points. This gives a maximum of 39 points (13 * 3) for the relevant questions. Dividing the resulting score by 39 gives a percentage figure. If all thirteen responses gave a score of “excellent” would give a result of 100%.