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
Tarawa, Republic of Kiribati
2 - 8 July 2003

Tarawa Technical Training Institute
Tarawa, Republic of Kiribati
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2 Institute of Refrigeration Heating and Air-Conditioning Engineers (IRHACE) Industry Training Charitable Trust (Inc.), New Zealand
3 Ministry of Environment and Social Development, Republic of Kiribati
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.),
MESD  Ministry of Environment and Social Development
MIT  Manukau Institute of Technology
NCAP  National Compliance Action Plan
ODS  Ozone Depleting Substances
PICs  Pacific Island Countries
ROAP  Regional Office for Asia and the Pacific
SPREP South Pacific Regional Environment Programme
TTTI  Tarawa Technical Training Institute
UNEP United Nations Environment Programme
UNON United Nations Office at Nairobi
UV-A Ultraviolet A radiation
UV-B Ultraviolet B radiation

Acknowledgements

This project has been undertaken with financial assistance provided by United Nations Environment Programme Multilateral Fund Secretariat and the bilateral contribution from the Government of Australia. Our appreciation goes to the Ministry of Environment and Social Development of the Government of the Republic of Kiribati for their in-country support and to all the participants of this workshop for their participation and providing the necessary information needed for implementing the Montreal Protocol in Pacific island countries.
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 in early 2002. 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 the United Nations Environment Programme Division of Technology, Industry and Economics (UNEP DTIE) and the United Nations Environment Programme Regional Office for Asia and Pacific (UNEP ROAP).

The train-the-trainers workshop in Kiribati is the first workshop of its kind in the PIC region, as part of the implementation of Kiribati’s National Compliance Action Plan. The main objective of the training programme is to reduce the CFC consumption in the refrigeration and air-conditioning sector in Kiribati 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 train the remaining service technicians in the refrigeration and air-conditioning sector in Kiribati. 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 Kiribati Government’s Ministry of Environment and Social Development (MESD), 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.

Ms Tessie Eria Lambourne, Senior Assistant Secretary, MESD, opened the workshop on behalf of the Kiribati Government. During the train-the-trainers workshop, eight professionals from industry and service workshops were trained on Good Practices in Refrigeration. The participants represented all but one refrigeration workshop in Tarawa.

The workshop included lectures on the harmful effects of depletion of the ozone layer 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 Kiribati.
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1. Introduction
Kiribati comprises three groups of islands spanning across the equator – the Gilberts, the Phoenix and the Line Islands. These islands, although covering only some 880km² of land area, are spread over 3.5 million km² of territorial waters. Most of the islands are only three to four meters above mean sea level and there are few places where the islands are wider than 1km although some are relatively long. Tarawa is the capital of Kiribati and is located in the Gilbert Group. In South Tarawa, monthly temperature maxima vary between 33°C and 35°C. The mean temperature is about 28.3°C (as advised by the Meteorological Office).

The most recent census was in 2000 with a preliminary result of a population of 84,494 and an estimated annual growth rate of 1.69%. Of this total 36,717 or just under half of the population live on one island: South Tarawa.

The majority of the population, lead a largely subsistence lifestyle and the standard of living is low. The 1995 GDP (Gross Domestic Product, the most recently published figure) was AUS$ 62.3 million (Approximately US$32 million). Most development is concentrated on the main island of South Tarawa, although tourist developments also exist on other islands and there is a large resort planned for Kiritimati (Christmas) Islands, which will be built by the Japanese. Most inhabitants do not have electricity in their houses.

There are no significant manufacturing industries in Kiribati and most goods are imported from Australia, Fiji or Japan. Almost all imports pass through Australia or Fiji before being sent to Kiribati. Therefore the country of origin of imported goods is often reported as being from Fiji or Australia, even when it has come from elsewhere. There is also trade with the Micronesian Countries such as the Republic of the Marshall Islands and Federated States of Micronesia (FSM).

Because Kiribati is a small group of islands, with fairly constant trade winds, corrosion from salt air is a serious problem. Accordingly steel products, such as cars, but also refrigerators and air-conditioners, suffer from severe corrosion problems. The average life of a car in Kiribati is around five years after arrival in the country because of the corrosion. As a result of the influx of cheap, but relatively old second hand vehicles, the disposal of car bodies is becoming a major environmental problem.

Fish is the principal food of the Kiribati people, who are known to be among the people with the highest per capita consumption rate in the world. It is not surprising that fisheries related activities are predominant in Kiribati. Household-source of income as a unit indicates that dependency of households on income from fishing activities ranks third after employment, and copra (National Planning Office, 1997). An increase in the use of coolers, and home refrigerators for catch is noticeable. On a larger scale, Government’s owned fishing company, Central Pacific Producers (formerly Te Mautari Ltd.), operates a 2x50 tonnes cold storage facility. Refrigeration is therefore an essential part of the food production system for the urban population in South Tarawa.

Fire fighting service is a responsibility of the Police Department who provide a standby service at Bonriki Airport during landings and takeoffs of aircraft. Important Government buildings and other buildings that are prone to fire are provided with fire fighting equipment.

Kiritimati Island
Although Kiritimati Island is part of Kiribati it is more than 2000km from the capital in Tarawa and there are no direct flights between Tarawa and Kiritimati. At the time of submission of this report, it has not been possible to collect any statistics on use of ODS on Kiritimati Island.
The lack of information on Kiritimati Island is of concern because, in addition to tourist developments, a multinational project called “HOPE-X” involving satellite landings and transhipments, with a complex telecommunication and scientific establishment are being established on Kiritimati Island.

It is possible that there would be consumption of CFCs for servicing vehicles and almost certainly of HCFCs for servicing refrigeration and air-conditioning equipment. Although the international project would not be eligible for assistance with phase-out, its ODS use will still count for Kiribati’s consumption. In addition to the HOPE-X project, there may also be consumption by local companies, such as hotels and shops, which may potentially be eligible for assistance. Their level of ODS consumption is unknown at this time.

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 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 Kiribati was the first training workshop carried out in the region under the Regional Strategy. The tutor, 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 un-met, 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 Kiribati 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.

Unlike most other PICs, few of Kiribati’s refrigeration technicians have received formal training in a technical training centre. There are no training facilities in Kiribati that teach practical refrigeration skills and few technicians have the financial resources to travel off-island for advanced training. Most Kiribati technicians have learned their trade “on the job” either on Japanese-owned fishing boats (which are required to train locals as part of their licensing arrangements) or they have learned from others in the country.

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

5. Participants

The eight participants who attended the full course were selected by the Ministry of Environment and Social Development (MESD) in consultation with SPREP and the trainer. The eight included representatives from all major refrigeration and air-conditioning service organisations except one, which failed to attend despite indicating that they would. Representatives from MESD also attended certain sessions to increase their awareness of the Montreal Protocol. The level of skills ranged from a few years experience in the industry, to more than twenty years practical experience.

The list of participants is attached as Annex 10.2.

The instructor for the workshop was Mr. Mike Dubey of the IRHACE Industry Training Charitable Trust (Inc) and he was assisted by the SPREP Regional Consultant Mr Iain McGlinchy. The Ozone Officer, Mr Andrew Teem of MESD 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 Kiribati workplace.

Few of the technicians had a good grasp of the basic principles of refrigeration and this is an area which may need to be addressed separately. Only one refrigeration-repair workshop in Kiribati had any form of CFC-recovery or recycling equipment and this was broken and had not been used for several years. We were informed that the very high levels of corrosion and very poor condition of roads meant that most equipment failures were catastrophic and little if any refrigerant remained in vehicles or refrigeration and air-conditioning equipment when it was repaired. Planned maintenance is rare. The difficulties of servicing equipment are also compounded by limited access to spare parts in Kiribati. These must be ordered from off-island and may take many months to arrive.

Opening Statement

Ms Tessie Eria Lambourne, Senior Assistant Secretary, MESD, welcomed the participants and thanked SPREP and the IRHACE Training Trust for organising the workshop. The workshop is important to ensure Kiribati achieves its obligations under the Montreal Protocol. She stressed the need to improve and upgrade the existing skills used in the servicing and maintenance of equipment in the refrigeration sector. She wished the participants success, and that as trainers, will go out and train novice technicians around Kiribati.
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 Kiribati, 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. UNEP’s “Training Manual on Good Practices in Refrigeration” was used as resource document.

There will be several years during which CFC and non-CFC based equipment will be operated side by side in Kiribati. 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 Kiribati 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 ozone layer protection 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 participants passed a written examination based on the “No Loss” programme operating in New Zealand. The participants will receive photo ID cards to say that they passed the course. They will all also receive certificates from the IRHACE Industry Training Trust. The workshop agenda is attached as Annex 10.1.
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 where 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 eight 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.
- 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:

- The local organisation was excellent. The classroom was well suited to the task (although it did lack ceiling fans, which made concentration difficult in the middle of the day). A nearby refrigeration company’s workshop was used for two practical sessions and was appropriate for the practical hands-on sessions.
- Lunch for the participants was organised at the training institute, which saved time and avoided local transport.

Environmental issues concerning the disposal of contaminated refrigerants, oil and other used material was also raised in discussions. The tutor and RC advised that the best technique to deal with 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.

During the course it became clear that bulk CFCs were no longer available in Kiribati. Following the decision of the Fiji Government to phase out imports of CFCs in 2000, the supply of CFCs into Kiribati has also ceased. 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 Kiribati, although this will remain possible until regulations prohibiting the import are put in place.

It was also made clear to the Regional Consultant and the tutor that there was little opportunity for recovery of significant quantities CFCs 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.

Figure 3: An example of a corroded condenser in Kiribati.
For similar reasons, the salt air and very poor state of the roads meant that servicing car air-conditioning was rare. The small amount of working vehicle air-conditioning equipment that is serviced is reported to all be using HFC-134a as there is no CFC-12 available. Only one company, Tarawa Motors, (which holds a Toyota franchise) was reported to regularly service vehicle air-conditioning. Their nominated participant did not attend the course and efforts to meet with representatives were unsuccessful.

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 Kiribati at present. This practice is unacceptable and should be eliminated everywhere. The MESD may need to assist workshops to obtain supplies of dry-nitrogen from Fiji as part of their implementation of the NCAP.

The advantages of practical hands-on training were brought home during the course when the tutor used a domestic fridge that was in the workshop to demonstrate leak detection using ultrasound while the system was being evacuated. The participants found the leak in the condenser within a minute and were quite impressed and immediately wanted to purchase detectors for their own workshops.

9. Follow up Action Plan

This training programme is part of the process of implementing the NCAP for Kiribati. 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 National Compliance Centre located in the MESD, ensuring the continued and successful phase-out of CFCs in the refrigeration sector. The MESD 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 training-the-technicians programme.

The course participants all indicated they would appreciate the opportunity for further technical training in other areas of refrigeration practice. We discussed this with the Principal of the Tarawa Technical Training Institute (TTI) and he was also keen to carry out further training at their facility. Unfortunately, the focus of the SPREP project is on the environmental issues, and the project does not have a mandate (or funds) to carry out any trade-training. Approaches have therefore been made to NZAid to see if any funding would be available from the NZ Government to carry out additional and longer (possibly several weeks or even month long) technical training in Kiribati, and possibly other Pacific Islands if appropriate.

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 Kiribati, under the Regional Strategy, has been allocated US$8,000 (approx. AUS$12,000) 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 of the trainer and the Regional Consultant that because of the patterns of ODS usage and type of equipment failure, there was little need for recovery and recycling equipment in Kiribati. The very small volume of CFC still in circulation did not justify the relatively high cost of dedicated 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 tutor, 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 + ½” + 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 on Tarawa.

The participants did not decide of any equipment should be provided at no cost, or at a subsidised price. This matter was to be discussed at a meeting of affected parties that the MESD intended to hold following the training workshop.

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

10. Evaluation by the participants

The evaluation of the programme was carried out on the afternoon of the last day. The evaluation Questionnaire and a detailed analysis of the results is available in Annex 10.3. Eight participants attended the week’s training and eight evaluation forms were returned. Most answered all questions, although there were some blanks and one question was missed by most due to a formatting problem on the printed form.

The results of the written evaluation vary and are difficult to interpret. In the overall evaluation questions most rated the course highly. Six of eight rated it “Very valuable for my work” or “Definitely useful for my work” and all of the eight rated the Training Trust as “Excellent” or “Very good” as a training organisation. However in the responses question 17 which asked their opinion on the quality of training in specific areas 3/8 consistently rated the training as only “good” and several respondents only rated specific aspects of the training as “acceptable”.

These relatively low “scores” do not fit well with the verbal feedback, both formal and informal, or the outcomes of all passing their examinations. Discussions with Mr Teem, of MESD suggest that the participants may have had difficulties understanding the relatively complex English of the written form and possibly had difficulties with the tutor’s accent. The communication difficulties may be borne out by the response to question 9, which asked about participants communication with the tutor and which received the lowest score of any of the questions.
11.1 Agenda

### DAY 1

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<td>8.15 – 8.30</td>
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<td>8.30 – 10.00</td>
<td>Introduction</td>
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<td>10.15 – 12.00</td>
<td>Basic Refrig Theory</td>
<td>Basic Refrigeration (PP)</td>
<td>14 slides</td>
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<td>12.30 – 3.00</td>
<td>Refrigerants &amp; Safety</td>
<td>Refriger (PP)</td>
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<td>3.15 – 4.30</td>
<td>Basic Refrig Practical</td>
<td>Copper Tube Work Cut &amp; Bend (Vid)</td>
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<td>Training Trust Presentation (PP)</td>
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<tr>
<td>8.30 – 10.00</td>
<td>Ozone Depletion</td>
<td>Science Presentation (PP)</td>
<td>50 slides</td>
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<td>10.15 – 12.00</td>
<td>Montreal Protocol</td>
<td>Montreal Protocol &amp; Where ODS..(PP)</td>
<td>34 slides</td>
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<td>12.30 – 3.00</td>
<td>Global Warming</td>
<td>(end of) Science Presentation (PP)</td>
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<td>3.15 – 4.30</td>
<td>Basic Refrig Practical</td>
<td>cont. Lab # 17A (from notes)</td>
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<td>Recovery</td>
<td>Recovery (PP)</td>
<td>16 slides</td>
</tr>
<tr>
<td>12.30 – 3.00</td>
<td>Leak Detection</td>
<td>Leaks (PP)</td>
<td>50 slides</td>
</tr>
<tr>
<td>3.15 – 4.30</td>
<td>Press Test Evac &amp; Charg</td>
<td>Pressure (PP)</td>
<td>24 slides</td>
</tr>
</tbody>
</table>

### DAY 4

<table>
<thead>
<tr>
<th>Session</th>
<th>Subject</th>
<th>Presentation (PowerPoint or Video)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15 – 8.30</td>
<td></td>
<td>Training Trust Presentation (PP)</td>
<td>self running</td>
</tr>
<tr>
<td>8.30 – 10.00</td>
<td>Retrofitting</td>
<td>Retrofit (PP)</td>
<td>46 slides</td>
</tr>
<tr>
<td>10.15 – 12.00</td>
<td>Review of Course to Date</td>
<td>Refrigerants Change Over Series (Vid)</td>
<td>30 mins</td>
</tr>
<tr>
<td>12.30 – 3.00</td>
<td>“No-Loss” Exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.15 – 4.30</td>
<td>TXV &amp; Superheats</td>
<td>Superhea (PP)</td>
<td>46 slides</td>
</tr>
</tbody>
</table>

### DAY 5

<table>
<thead>
<tr>
<th>Session</th>
<th>Subject</th>
<th>Presentation (PowerPoint or Video)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15 – 8.30</td>
<td></td>
<td>Training Trust Presentation</td>
<td>self running</td>
</tr>
<tr>
<td>8.30 – 10.00</td>
<td>Mobile Air Conditioning</td>
<td>Setting LP/HP &amp; OP Switches</td>
<td></td>
</tr>
<tr>
<td>10.15 – 12.00</td>
<td>Resit “No-Loss” Exam if Required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.30 – 3.00</td>
<td>Question Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.15 – 4.30</td>
<td>Discussion</td>
<td>Course Evaluation</td>
<td></td>
</tr>
</tbody>
</table>
11.2 List of Participants

1. Betero Tawetia  
   Central Pacific Producers  
   PO Box 508, Betio  
   Tarawa  
   Republic of Kiribati

2. Kenneth Inatio  
   Mary's Kool  
   PO Box 12, Bairiki  
   Tarawa  
   Republic of Kiribati

3. Naike Tiiu  
   Tiebo Electrical and Refrigeration Services  
   PO Box 537  
   Republic of Kiribati

4. Terakoro Tuare  
   Tarawa Fisherman's Co-operative Society  
   Bairiki, Tarawa  
   Republic of Kiribati

5. Mr (Henry) E.H Barekiau  
   Kiribati Port Authority  
   PO Box 586  
   Betio, Tarawa  
   Republic of Kiribati

6. Mareko Teribwa  
   Tema-Cool Services  
   PO Box 9, Bairiki  
   Tarawa  
   Republic of Kiribati

7. Tiira Aree  
   Tiebo Electrical & Refrigeration Services  
   PO Box 537, Betio  
   Tarawa  
   Republic of Kiribati

8. Teevi Tiim  
   Tiebo Electrical & Refrigeration Services  
   PO Box 537, Betio  
   Tarawa  
   Republic of Kiribati
11.3 List of Resource personnel

1. Mr Mike Dubey
   Institute of Refrigeration Heating and Air-Conditioning Engineers (IRHACE) Industry
   Training Charitable Trust (Inc.)
   IRHACE Centre 28 E Lambie Drive
   Manukau City
   PO Box 97453 SAMC
   Auckland
   New Zealand
   Telephone: (64-9-2621405)
   Fax: (64-9-2621406)
   E-mail: admin@irhace.org.nz

2. Mr Iain McGlinchy
   SPREP Regional Consultant
   50 Wilson Street
   Newtown
   Wellington 6002
   New Zealand
   Telephone: (64-4-3801147/3895607)
   Fax: (64-4-3801148)
   E-mail: iainmcg@xtra.co.nz

3. Ms Tessie Lambourne
   Senior Assistant Secretary
   Ministry of Environment and Social Development
   PO Box 234
   Bikenibeu
   Tarawa
   Republic of Kiribati
   Telephone: (686-28211)
   Fax: (686-28334)
   E-mail: sas.mesd@tskl.net.ki
11.4 Evaluation Questionnaire

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

Results of Course Evaluation by Kiribati
<table>
<thead>
<tr>
<th>Questions/Responses</th>
<th>Weighted average</th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Acceptable</th>
<th>Unacceptable</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1. The equipment used during the course was:</td>
<td>88%</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Question 2. The fulfilment of my expectations of this training was:</td>
<td>59%</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 3. The preparation of classroom sessions by presenters was:</td>
<td>69%</td>
<td>4</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 4. The lectures and classroom discussions were:</td>
<td>63%</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 5. The quality of course notes that I was given was:</td>
<td>59%</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 6. The content of the course notes was:</td>
<td>69%</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 7. The presenter's use of teaching aides e.g. projector was:</td>
<td>72%</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 8. The presenter's knowledge of the subject material was:</td>
<td>78%</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 9. My communication with the presenter was:</td>
<td>47%</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Question 10. The encouragement of and responsiveness to participants questions was generally:</td>
<td>56%</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 11. Overall I rate this course as:</td>
<td>72%</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 12. The amount of material covered during the course was:</td>
<td>Too Much</td>
<td>About Right</td>
<td>Too Little</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 13. I regard this course as:</td>
<td>Very valuable for my work</td>
<td>Definitely useful for my work</td>
<td>Somewhat useful for my work</td>
<td>Of little use for my work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 14. Overall, how would you rate IRHACE Training Trust as a training organisation:</td>
<td>Excellent</td>
<td>Very Good</td>
<td>Average</td>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerned did you find them adequate in explaining:</td>
<td>56%</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>a) Environmental issues</td>
<td>75%</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b) Basic principals of refrigeration</td>
<td>78%</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) CFC/HCFC/HFC/HC refrigerants and technologies</td>
<td>78%</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) General trade safety</td>
<td>75%</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Operation and use of trade specialty tools</td>
<td>88%</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Operation and use of passive and active recovery devices</td>
<td>31%</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NB Most did not answer this question.</td>
<td>69%</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>g) Good refrigeration practices</td>
<td>69%</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Retrofitting to alternative refrigerants</td>
<td>69%</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Creating preventive maintenance programs and record-keeping</td>
<td>69%</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 18. Has the recovery issue been adequately dealt with in the practical hands-on sessions</td>
<td>59%</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>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)</td>
<td>59%</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

In order to summarise the responses, a weighted average has been used. A response of “Excellent” was given four points, a response of “very good”, three, “good” two “acceptable” one and unacceptable and blank responses were given zero points. This gives a maximum of 32 points for the relevant questions. Dividing the resulting score by 32 gives a percentage figure. If all eight responses gave a score of “excellent” would give a result of 100%.