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**United Nations Industrial Development
Organization**



**Phasing-out ODSs at Eletrofrio S/A
Curitiba, Brazil**

Project No. MP/BRA96/208

FINAL REPORT

June 1999

**Trans-Mond Environment Ltd.
Korkeavuorenkatu 25 A, 00130 Helsinki, Finland
Tel +358-9-170002, Fax +358-9-170009
E-mail tme@tme.inet.fi**

EXECUTIVE SUMMARY

This is the Final Report covering the implementation of contract No. 97/259 for project no. MP/BRA/96/208, Eletrofrio Co. The contract was to deliver equipment to replace CFC 12 refrigerant with HCFC-22 and HFC-404a, train the staff to use the new equipment and advise the client in initiating the operation with new coolant.

The equipment delivered was tested on 17-19 May, 1999 and the training of the client's staff finalised on 20 May, 1999.

The client company is now prepared to deliver refrigeration systems using HFC-404a refrigerant. All equipment are for supermarkets, components are designed and pre-manufactured at Eletrofrio's manufacturing site in Curitiba, installed at supermarkets' sites throughout Brazil and neighbouring countries. The vacuuming, charging and leak testing are done on the sites.

1. TRAINING

Eletrofrio Co. has approximately 400 employees at the production plant in Curitiba and field staff of 250-300 people. Part of the field work, i.e. installations are contracted by small individual companies. The production plant doesn't handle very much the coolants. The refrigeration units are assembled on site tubing connected to the engine room. The leak testing, vacuuming and charging are on the site. This poses difficulties for the training. Due to the large area of operation (practically all Brazil) it was not possible to train the field staff, but the training was to introduce train-the-trainers concept.

The training was carried out in Portuguese during the week 20/99 ending on 20 May, 1999.

The local trainer contracted (Mr. José Antonio Barbedo) has a degree in mechanical engineering and has been working several years with the equipment manufacturer Robinair in the area of service and maintenance of refrigerating systems. Mr. Barbedo has experience in training issues and is familiar with the refrigeration industry standards, technical skills of the staff and equipment and refrigeration systems installed.

The following people from the Eletrofrio's staff participated:

Mr. Marcos C. Wippel, Mechanical Engineer, Refrigeration technology dept
Mr. Luiz Carlos Lima, Chemical Engineer, Process engineering dept
Mr José Augusto Lomes, Mechanical Engineer, Installation eng. dept.
Mr. Marcos Santos Rangel, Mechanical Engineer, Installation eng. dept
Mr. Marcelo H. Ribeiro, Mechanical Engineer, Installation eng.dept
Mr. Yen Chen Pong, Designer, Installation eng. dept
Mr. Rafael Povia, Refrigeration Technician, Refrigeration technology dept

The training covered the following issues using the new equipment:

- Refrigerant R-404A : blend, solubility of oil, grease, wax etc.
- Polyol ester oil: viscosity, lubricating characteristics, hygroscopy, hydrolysis, acid components, corrosion, miscibility with refrigerant and mineral oil.
- Cleanliness of tubing and components,
- Brazing, pressure testing (nitrogene) and leak testing of installation
- Evacuation of system at low and high pressure side.
- Where to connect vacuum meters, level of vacuum
- Charging, from liquid phase.
- Vacuum pumps: ballast, retention valve, oil charge, maintenance, oil change, precautions due to hygroscopy of oil.

- Vacuum meters: function, precautions, hook up, reading, maintenance, battery change, calibration.
- Leak testers: operating principle, utilisation, maintenance, calibration.

The technical issues related to the above mentioned training components have been explained in more detail in Progress Report 2. The equipment supplier has delivered technical manuals (in Portuguese) for the disposal of Eletrofrio co.

The people who participated in the training will be in charge for the manufacturing of the components at the production plant and further for supervising the installation in field at client supermarkets.

The equipment delivered will be kept at the production plant, but Eletrofrio will most likely procure additional equipment from the same supplier, which equipment will be delivered to the field staff.

2. START OF MASS PRODUCTION

Mass production of the refrigeration equipment is more a commercial than a technical issue with Eletrofrío Co. The upgrading of the production process to use non-ODS refrigerants is now done, but the company still has some capacity to deliver HCFC-22 based systems. The speed of actual conversion is dictated largely by the government's policy and clients' financial capacity to pay higher price for non-ODS coolants. The price of coolant for initial charge hardly plays any role, but the annual maintenance and recharging costs are an important factor when deciding the conversion.

The components needed to assemble a complete ODS-free system are hardly more expensive than the old components. The non-CFC compressors can now be procured at prices which are same or lower than ODS run compressors.

The company has also converted the insulation material from ODS to non-ODS. Since the products can now be claimed completely "green", i.e. ODS free, this could be utilised as a marketing boost, introducing green labelling etc.

The current production of Eletrofrío is approximately 15000 meters of cooling, refrigerating and freezing modules. The ODS consumption is some 45-50 tons p.a., almost all for initial charge. It can be estimated that the company has now ability and capacity to turn all the production ODS free. The actual rate of conversion is largely dictated by commercial conditions.

The weak point in introducing and adapting non-CFC equipment is the fact that maintenance of the equipment, after one year's warranty period, is still performed by people who do not necessarily have any good training or maintenance equipment.

Eletrofrío Co. is the largest Brazilian company in the commercial refrigeration market. The recent changes in the ownership structure (owners have strong interests in the supermarket business) mean that the commercial aspects will dominate the business. In practice this means that Eletrofrío's largest customers, supermarket chains, are more and more adopting "green" policies, which reflects in the cooling and refrigeration equipment.

It may be noted that several foreign supermarket chains from Northern America and Europe are now entering into the Brazilian market. These companies are applying "green" policies, which means e.g. a complete ban of ODS run refrigeration equipment at the outlets. The rapid degree of urbanisation has meant that some 85 % of primary consumers products (including food) are now sold through supermarket chains. This presents good prospects for non-ODS refrigeration equipment produced by Eletrofrío.

The company management is well aware of the ODS phase-out requirements and is now willing to promote a policy which aims at phasing out the ODSs at an accelerated rate, i.e. not utilising the grace period allowed for article 5

countries like Brazil. Trans-Mond Environment Ltd. thinks that the Eletrofrío conversion is setting a good example for the government, too. Official policies regarding imports of ODS as substance and ODS consuming equipment could be tightened by setting quotas and bans without harming the local consumers.

Minutes of Meeting

Certificate of Acceptance

UNEP Project No. NEP/BRA/96/203, contract No. 97/253

Counterpart: Eletroirto, Curitiba, Brazil

Contractor: Trans-Mund Environment Ltd.

Date: of May, 1999

1. It was stated that Trans-Mund Environment Ltd. according to the aforementioned contract and its annexes/modifications, has procured and delivered chiller and other equipment for the refrigerant R-404a from Robinair Div. SPX Corp., USA, as listed in an invoice ENEP 003/99 of March 7, 1999 from Robinair's representative Jurubatech Ltda. São Paulo, Brazil. It was further stated, that the equipment arrived complete and in good and original shape at the counterpart's site in Curitiba.

2. It was stated that the equipment has been tested in the presence of authorized representatives of the counterpart and of UNEP's national consultant, and that the equipment conforms to the requirements set in the Terms of Reference of the project/contract.

For Counterpart: [Signature]

For UNEP: [Signature]