THE THREE R'S – RESULTS OF AN INTERNATIONAL ASSESSMENT OF POLICIES, PRACTICES AND NATIONAL PLANS

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Abstract

The International Energy Agency (IEA) Heat Pump Centre has conducted a study to gather information on the refrigerant recovery, recycling, and reclamation policies being pursued in representative countries of major markets located in Asia, Europe, and North America. The study was aimed at comparing and contrasting the effectiveness of different approaches, and where possible to quantify subsequent emission reductions and environmental and cost benefits.

Input on the relevant issues covering policies, practices and national plans was obtained directly from experts within the various countries, with additional material being provided by an international project technical advisory group. This information has been analyzed and fully documented in an IEA Heat Pump Centre project final report. This paper provides an overview of the contents of that report, and serves to highlight the diversity of approaches with regard to policies, regulations, and practices for accomplishing recovery, recycling, and reclamation of refrigerants in different countries within major market areas.

1. Introduction

Curtailment in the consumption of ozone-depleting substances as required by the Montreal Protocol is leading to the gradual phaseout of CFC and HCFC refrigerants in both developed and developing countries. Furthermore, one of the consequences of introduction of the Kyoto Protocol (or any alternative programs aimed at addressing global warming issues) will entail reduction of emissions from HFCs, which are increasingly being used in many countries as replacements for CFCs and HCFCs.

The need to achieve such reduced emissions is having a profound impact on the refrigeration, air-conditioning and heat pump industries, and the effects are far reaching for equipment manufacturers, installers, end users, service technicians, etc. Refrigerant conservation is a critically important element in the management of controlled refrigerants and must be applied throughout the life cycle of the refrigerants and of the plant (IIR 1999). This includes production, transportation, storage, and usage of refrigerants as well as design, construction, operation, and decommissioning of equipment.

Recovery, recycling, and reclamation of refrigerants is a major consideration in conservation requirements. It has been recognized in many countries that the adoption of such practices is crucial to ensure compliance with phaseout commitments, while continuing to satisfy present and future equipment service requirements. Recovery, recycling, and reclamation programs play an essential role in emission reduction, while at the same time ensuring a supply of necessary refrigerants which will become increasingly scarce and more costly in the future. The approach to implementation of such programs varies from one country to another and this study, conducted under the IEA Heat Pump Centre's work program, was undertaken to investigate and compare the different strategies employed in several selected countries.

2. Purpose and Scope

2.1 Objective

The overall objective of the study was to document refrigerant recovery, recycling, and reclamation policies, practices, and national plans in countries representative of major refrigeration and air-conditioning markets located in Asia, Europe, and North America. The analysis was intended to quantify where possible the corresponding emissions reduction impacts and compare and contrast the effectiveness of different policy approaches.

2.2 Scope

Coverage of the above issues was structured to include the following aspects:

- Standards and regulations concerning the recovery/recycling/reclamation of various refrigerants, and how these are being enforced in the air-conditioning and refrigeration servicing industries
- Description of the different approaches used to mandate or encourage reclamation and reuse (including voluntary agreements), and an assessment of their effectiveness as practiced
- References on and descriptions of any relevant market-based and economic incentive approaches
- Data on national experiences with production of new refrigerants, "aftermarket sales" or other available indicators of reduced refrigerant leakage (emissions)
- Analysis to quantify emission reduction benefits, and potential global impact
- Assessment where possible of economic costs/benefits of refrigerant leakage abatement, due to adoption of programs for recovery/recycling and reclamation/reuse of refrigerants

The geographical scope of the project was focused on countries with a well-defined program or plan on refrigerant recovery/recycle/reclaim. Not all countries responded to the survey inquiry document, but sufficient information was received back from Australia, Canada, France, Japan, The Netherlands, and the U.S. Input derived from these sources provided a representative cross-section of experiences from programs existing in Asia, Europe and North America.

3. Refrigerant Emission Reduction Strategies

3.1 Refrigerant Containment

In the case of refrigeration, air-conditioning, and heat pump systems the various equipment components are designed as sealed units and are intended to provide long term operation without any significant leakage. However, containment of refrigerant and maintenance of leak tightness in such systems is affected strongly by the design, installation, operation, and servicing of equipment, and careful attention must be paid to all of these issues if emissions are to be minimized.

The design of leak-tight systems requires that manufacturer pay special attention to such items as choice of materials for components, minimization of connections using flare joints and screw fittings, careful selection of safety relief valve settings, and detailed specification of `installation and service procedures. Optimization of refrigerant charge held within the system contributes to the limitation of emissions, and significant reductions in refrigerant inventory can be achieved with innovative approaches to equipment design.

Proper installation and commissioning procedures are critical to ensure system leak tightness, and contractors should follow an industry Code of Practice where applicable. Special attention should be paid to tightness of connections, system evacuation to remove air and non-condensables, correct charging methods, and pressure testing according to appropriate standards.

During operation the accurate measurement of leak tightness with suitable detection equipment is important. Monitoring may be conducted periodically using manual detection techniques or continuously with permanent electronic systems such as those installed in large plant and machine rooms.

Service technicians should receive adequate training and only qualified personnel should be involved in refrigerant maintenance activities. Service sheets or a logbook should provide up-to-date records of all additions or removal of refrigerant/oil from a system and include details of leakage repairs and causes if known.

3.2 Recovery, Recycling, and Reclamation

As well as containment of working fluids within the cooling system many countries have recognized that the emission of refrigerants can be greatly reduced by having effective recovery, recycling, and reclamation (R/R/R) programs in the refrigeration and air-conditioning industry.

The meanings of the terms involved in R/R/R terminology are very specific when applied to the refrigeration industry and the corresponding definitions of these words are as follows:

Recovery refers to the removal of refrigerant in any condition from a system and storing in an external container without necessarily testing or processing it in any way. Recovery avoids venting refrigerants to the atmosphere, and is a necessary first step prior to recycling or reclamation.

Recycling means to clean and filter used refrigerants for reuse, most commonly by using oil separation and filter-dryers to reduce the level of contaminants. This procedure is usually implemented at the field job site or at a local service shop. The recycled refrigerant may be reused again in the same facility or resold where permitted, but the refrigerant purity levels are uncertain.

Reclamation requires that the used refrigerant be reprocessed to meet new product specifications according to standards such as ARI 700-1988, and the purity level must be verified by chemical analysis. This term implies the use of a process or procedures available only at a reprocessing or manufacturing facility.

4. Country Specific Survey

4.1 Questionnaire

In order to study the different policies and approaches to refrigerant recovery, recycle, and reclaim being taken by various countries a questionnaire addressing 25 issues was used to solicit key information about R/R/R programs from a selection of countries. In attempts to ensure an adequate level of responses the content of the questionnaire was kept as brief as possible, while at the same time aiming to elicit sufficient important information including:

- description of type of program (market-based/economic incentives; voluntary/mandatory)
- systems/applications covered
- management, financing arrangements
- standards, regulations, certification requirements, enforcement method(s), penalties
- experiences gained on reduced refrigerant use and production
- economic cost benefits of reduction measures

4.2 Survey Results

Input to the questionnaire produced basic initial input from six countries (Australia, Canada, France, Japan, Netherlands, USA). Further information was subsequently gathered from follow-up contacts in those countries and through other sources. For easy comparison purposes the various

responses have been synthesized and the main points condensed into a set of tables that provide a brief summary of the situation in each country (Tables 1 to 6).

Table 1. Refrigerant Conservation Measures and Regulations: AUSTRALIA

Refrigerant Conservation Program	Industry-run national program responsible for recovery, recycle, reclaim, and safe destruction of all fluorocarbon refrigerants
Date Introduced	July 1993.
Control Organization	Refrigerant Reclaim Australia (RRA)
Refrigerants Included	Currently CFCs and HCFCs.
Applications Covered/Excluded	Refrigeration, Air-Conditioning and Heat Pumps (stationary and mobile market sectors)
Regulations and Enforcement Level	Mandatory regulation enforced by government legislation requiring recovery of ozone depleting refrigerants. Voluntary participation of companies in RRA program.
Finance Arrangements	Industry supported by payment of a levy added to the cost of all new refrigerant purchases. Service companies and wholesalers are recompensed for their refrigerant recovery activities.
Refrigerant Reclaim Infrastructure Availability	RRA makes arrangements for refrigerant recovery, provision of clean refrigerant containers, collection of containers, and transfer to reclaim or destruction facilities.
Programme Elements:	
Certification requirements	Certification of companies not required nationally, but accreditation under State law is generally necessary in order to purchase any ozone depleting refrigerants or to work on such systems.
Servicing practice requirements	CFCs and HCFCs must be recovered at service or disposal. Refrigerant may then be recycled, sent for reclamation, or destroyed.
Equipment requirements	Certification required (under State law) for some equipment used in recovery/recycling/reclamation.
Training/education requirements	Contractors must obtain accreditation under applicable State laws by completing a recognized trade course or satisfying other approved criteria.
Leak tightness inspection, documentation required	Annual leak tightness inspection is mandatory under the industry Code of Good Practice which is called up into law in some States. System leaks must be repaired prior to any new refrigerant being added.
Penalties for non-compliance	Under State law fines of up to $AUD240,000 may be imposed for knowingly releasing ozone depleting refrigerants plus a further $AUD120,000 per day for any continued violation.

Table 2. Refrigerant Conservation Measures and Regulations: CANADA

Refrigerant Conservation Program	Responsibility rests with provincial governments and all have programs in place controlling refrigerant Recovery, Recycling, and Reclaim.
Date Introduced	Separate legislation passed within the provinces at various times between 1993 and 1997.
Control Organization	Federal-Provincial Working Group (FPWG) on Ozone Depleting Substances and Halocarbon Alternatives established in Jan. 1998 to provide harmonization of control measures.
Refrigerants Included	CFCs, HCFCs, and HFCs.
Applications Covered/Excluded	Refrigeration, air-conditioning and heat pumps.
Regulations and Enforcement Level	Provincial regulations are enforced as appropriate where they apply to the various control measures. Federal regulations enforced at national facilities.
Finance Arrangements	Funded by federal and provincial government ministries having responsibilities for Ozone Depleting Substances.
Refrigerant Reclaim Infrastructure Availability	Ten out of 12 jurisdictions require containers to be refillable/recyclable. Industry uses ARI 700-1993 as the refrigerant reclaim standard.
Programme Elements:	
Certification requirements	Eleven out of 12 jurisdictions require certification of any technicians involved in refrigerant recovery/recycling activities
Servicing practice requirements	In all jurisdictions release of ODS is prohibited and refrigerant recovery, recycling or reclaiming is required during equipment service or disposal. All reports and records must be kept up to date.
Equipment requirements	Five provinces have standards in existence for safety and testing of refrigerant recovery and recycling equipment.
Training/education requirements	FPWG has implemented environmental awareness training programs in all provinces for equipment service personnel. ODP card issued on successful completion of training course. (Purchasers of any new refrigerant must possess an ODP card.)
Leak tightness inspection, documentation required	Annual leak testing required in four jurisdictions (excluding small equipment). Eleven jurisdictions require leak testing and repair prior to recharging and topping up of any equpment.
Penalties for non-compliance	Various penalties including fines (up to $ 1 million CAD) or imprisonment (up to 3 years) or both.

Table 3. Refrigerant Conservation Measures and Regulations: FRANCE

Refrigerant Conservation Program	Government run national programs in force covering refrigerant Recovery/Recycling/Reclaim and Leak Tightness Control
Date Introduced	Recovery/Recycling/Reclaim - December 1992. Leak Tightness Control – 1998.
Control Organization	Ministère de l'Environnement
Refrigerants Included	CFCs, HCFCs, and HFCs and their blends.
Applications Covered/Excluded	Refrigeration, Air-Conditioning and Heat Pumps (excluding residential/domestic appliances and automotive air-conditioning sectors and systems with charge less than 2 kg)
Regulations and Enforcement Level	Mandatory regulations enforced by government legislation.
Finance Arrangements	Industry supported by payment of a surcharge added to the cost of all new refrigerant purchases. To encourage refrigerant recovery a premium is paid as an incentive if returned product is reusable after recycling.
Refrigerant Reclaim Infrastructure Availability	Service companies make arrangements for refrigerant recovery, provision of clean refrigerant containers, collection of containers, and transfer to reclaim or destruction facilities.
Programme Elements:	
Certification requirements	Companies involved in installation, service, repair, or decommissioning of regulated equipment must be registered.
Servicing practice requirements	CFCs, HCFCs and HFCs must be recovered at service or disposal from equipment containing more than 2 kg of charge. Refrigerant may then be recycled, sent for reclamation, or destroyed.
Equipment requirements	Recovery, recycling, and reclamation equipment must be registered.
Training/education requirements	Technicians must possess a diploma, certificate, or similar qualification recognized in the EEC, or have six years of relevant professional practice.
Leak tightness inspection, documentation required	Annual leak tightness inspection is mandatory. Equipment owners and technicians must sign a special document whenever maintenance is carried out on a system, and records must be kept for at least three years.
Penalties for non-compliance	Fines of up to 6,000 FRF may be imposed, increasing to 12,000 FRF in case of repetition.

Table 4. Refrigerant Conservation Measures and Regulations: JAPAN

Refrigerant Conservation Program	Industry-run national program in place covering refrigerant Recovery, Recycling, and Reclaim.
Date Introduced	October 1993
Control Organization	Refrigerants Recycling Promotion and Technology Centre (RRC) - founded voluntarily by related industry associations
Refrigerants Included	CFCs and HCFCs.
Applications Covered/Excluded	Commercial refrigeration, air-conditioning and heat pumps (excluding residential/domestic appliances and automotive air-conditioning sectors)
Regulations and Enforcement Level	Refrigerant recovery and recycle regulation becomes law in 2002. Previously RRC promoted measures to encourage voluntary R/R/R activities within the industry. Safety of equipment during operation and service is regulated by High Pressure Gas Safety Law.
Finance Arrangements	Jointly funded 50/50 by government and industry.
Refrigerant Reclaim Infrastructure Availability	RRC makes arrangements for refrigerant recovery, provision of clean refrigerant containers, collection of containers, and transfer to reclaim or destruction facilities.
Programme Elements:	
Certification requirements	RRC participation requires certification of companies and any technicians involved in refrigerant recycling activities
Servicing practice requirements	CFCs and HCFCs voluntarily recovered at service or disposal. Refrigerant may then be recycled, sent for reclamation, or destroyed.
Equipment requirements	RRC has standards in existence for safety and testing of refrigerant recycling equipment.
Training/education requirements	Service technicians must acquire certification by attending a training course operated by RRC and passing the relevant examination.
Leak tightness inspection, documentation required	Inspection not required for most equipment, but large scale units (over 70 kW) are required under High Pressure Gas Safety Law to have annual maintenance including refrigerant leakage check.
Penalties for non-compliance	No penalties (voluntary system)

Table 5. Refrigerant Conservation Measures and Regulations: THE NETHERLANDS

Refrigerant Conservation Program	National program in place aimed at refrigerant leakage reduction and emission limitation through preventive maintenance.
Date Introduced	March 1993
Control Organization	STEK – an industry driven organization set up and authorized by national government
Refrigerants Included	All refrigerants except ammonia and flammable refrigerants.
Applications Covered/Excluded	All refrigeration, air-conditioning and heat pump applications with compressor power above 500W.
Regulations and Enforcement Level	Mandatory regulation (RLK) applied to companies involved in equipment installation/maintenance, with supporting government legislation in place.
Finance Arrangements	Industry supported by participating firms paying entry fees and annual dues.
Refrigerant Reclaim Infrastructure Availability	A few companies are currently set up with the equipment and facilities required to collect used refrigerant and conduct product reclamation.
Programme Elements:	
Certification requirements	Only companies with a STEK approval certificate are permitted to do service work on refrigeration, air-conditioning and heat pump equipment
Technical requirements	Specifications for materials, mechanical design of piping, joints, valves, gauges, overpressure protection, etc. are prescribed for various components to limit refrigerant emissions.
Training/education requirements	Service personnel must be qualified to work on installation and/or maintenance of equipment. They must pass a STEK-approved written examination.
Leak tightness inspection, documentation required	Inspection required annually if charge > 3 kg; quarterly if charge > 30 kg; monthly if charge > 300 kg. Leak testing equipment must have detection limit of at least 5 ppm. Any leaks must be repaired forthwith. No recharging permitted prior to repair. All maintenance activities to be recorded in system logbook.
Penalties for non-compliance	No financial penalties, but government inspection authorities (IHM) may impose sanctions with varying severity, up to withdrawal of licence.

Table 6. Refrigerant Conservation Measures and Regulations: USA

Refrigerant Conservation Program	National Recycling Rule in force which regulates refrigerant Recovery, Recycling and Reclaim
Date Introduced	May 1993
Control Organization	US Environmental Protection Authority (EPA)
Refrigerants Included	CFCs and HCFCs in the stationary sector CFCs, HCFCs, and HFCs in the mobile sector
Applications Covered/Excluded	Refrigeration, Air-Conditioning and Heat Pumps (stationary and mobile market sectors)
Regulations and Enforcement Level	Mandatory regulations enforced by authority from US Congress (Sections 608/609 of Clean Air Act)
Finance Arrangements	Financed by US Government. Funds are disbursed by EPA to regional program offices
Refrigerant Reclaim Infrastructure Availability	Checklist established for EPA approval of refrigerant reclaimers. (Over 60 companies are currently certified.) Refrigerant analysis procedures and measurement equipment must comply with ARI 700-1993 standard of purity.
Programme Elements:	
Certification requirements	EPA certification required for: • Recovery and recycling equipment • Service and repair technicians • Ownership of recycling/recovery equipment • Refrigerant reclaimers
Servicing practice requirements	CFCs and HCFCs must be recycled or recovered from equipment at service or disposal. Appliances must be evacuated to specific vacuum levels depending on type of appliance and the age of recovery/recycle equipment.
Equipment requirements	Recycling and recovery equipment manufactured since 1993 must be tested by an EPA-approved third party (such as ARI or UL). The equipment must comply with ARI 740-1993 standard.
Training/education requirements	Technicians must undergo mandatory training and pass EPA-approved test before being permitted to repair equipment or purchase refrigerants.
Leak tightness inspection, documentation required	Inspection not mandatory but for equipment containing charges of more than 50 pounds regulations require repair or replacement of appliances when leak rates exceed specified levels. Equipment owners must keep records of refrigerant quantities added during maintenance.
Penalties for non-compliance	EPA can assess fines of up to $USD 27,500 per day per violation

5. Discussion

Various issues resulting from the contents of this study were tabled for discussion during a workshop at the international conference "Refrigerant Management and Destruction Technologies of CFCs" that was held August 29-31, 2001 in Dubrovnik, Croatia (IIR 2001). The consensus reached on key issues and concerns emerging from these discussions are summarized below:

5.1 EU Regulation

According to the recent European Union regulation (EC 2037/2000) the use of CFCs is now prohibited (for refilling purposes, etc.) and effectively means that CFCs must be destroyed. This is causing serious concern among some EU countries, i.e. if CFCs cannot be reused there will be no reason for R/R/R. Furthermore since there will be costs involved in their destruction, the concern is that some of these CFCs will likely end up being released to the environment instead. Strong opinions were expressed by some, questioning the wisdom of this regulation. Clearly more information is necessary to obtain a better understanding of the rationale behind the legislation.

5.2 R/R/R Regulatory Policy

It was generally agreed that refrigerant R/R/R programs must be regulated and enforced by government legislation to ensure compliance. Otherwise the 'free-rider' issue becomes a problem, i.e. some operators will undermine the intent of the program by not paying for the benefits they receive. Voluntary programs that rely only on peer group pressure, monitoring, self-reporting, sanctions, etc. have been found to be ineffectual against those who choose to remain outside of the regime. As an example it was noted that even Japan's industry-based voluntary program would soon be enforced by new government legislation in process in that country, and similar actions are also planned in the UK.

5.3 Emission Reduction Strategies

Alternative emission reduction techniques are available, and leakage abatement can be achieved by adopting system containment measures that focus on making technical improvements in design/installation or by limiting emissions through careful refrigerant handling procedures during all servicing activities. Participants all agreed that a combination of these approaches was the most desirable situation, but solutions must be cost effective. Industry is seeking long term security and has concerns about cost implications whenever new measures are introduced.

In the case of developing countries it was pointed out that refrigeration equipment used there is often older and annual leakage rates are very frequently in the 30% range. New refrigerant management plans being developed for these countries need to be aware of such difficulties, and need to take into account prevailing industrial, political, economic and legislative situations.

5.4 Administration/Financing Arrangements

There are broad variations in approaches taken towards management, funding, operation, etc. for R/R/R programs. In some cases, e.g. USA and Canada, these activities are closely controlled by federal and provincial governments. In France and Australia programs are also government controlled, but financial support for operation and incentives are obtained from industry sources by levies charged on new refrigerant sales. A national program operating in The Netherlands has mandatory government enforced regulations, but has taken the additional step to set up a separate industry-driven self-supporting control organization (Vos 2001) to be responsible for management, operation, funding, etc. In Japan on the other hand industry associations have taken the initiative to set up a system for voluntary management of chemical substances (unregulated until recently), and control and facilitation of the whole program is essentially a private sector operation, with some supplementary funding input from government.

5.5 Training and Education

The importance of training and education and raising the competence and skills of all personnel in the market to a higher level of awareness was seen as an important precondition to ensure long term success of refrigerant R/R/R programs. It was emphasized many times that the provision of training, updating of information, and continuity of education of employees are the most important elements to maintain the required knowledge base within the industry.

5.6 Costs and Benefits

The benefits of such programs are primarily social ones related to improvements in health and safety, and therefore difficult to quantify. The detrimental effects on health care of increased levels of ultra-violet radiation have been especially significant in Australia and New Zealand, with one report indicating a 30% increase in DNA-damaging UV radiation over the past two decades at mid-latitudes in the southern hemisphere.

The only quantitative cost benefit analysis emerging from the study was that contained in the original Regulatory Impact Analysis (ICF 1993) conducted for the EPA in the US. That study attempted to estimate the total nationwide costs and benefits of refrigerant R/R/R regulation in that country for the period from 1994 to 2015. The detailed analysis included labour costs involved in recovery and recycling operations, costs of certification for technicians and equipment, storage costs for unused CFCs, and related costs of record keeping and paperwork. The social benefits were based on the avoidance of skin cancers and related fatalities associated with the harmful effects of stratospheric ozone depletion, and were calculated based on estimates of emission reductions amounting to 24,600 ODP-weighted tonnes of CFCs and 13,800 ODP-weighted tonnes of HCFCs. The financial gain obtained from the avoidance of a skin cancer fatality enters into a difficult and arbitrary decision area surrounding the value placed on lives saved. This analysis assumed a range where the lower bound was based on a value of $USD 3 million per life and the upper bound assumed a value of $USD 12 million per life. Within the modelling framework various other assumptions were made relating to atmospheric and health effects, choice of discount rate, etc. Based on these various assumptions the final results of this analysis indicated total estimated costs of $USD 1.28 billion with benefits ranging between $USD 420 million and $USD 1.69 billion (corresponding to the alternative assumptions used regarding the value of a life saved).

6. Conclusions

All six countries surveyed have national programs and policies in place with regard to prohibition of the release of ODS, and similar certification requirements exist for the recovery, recycling, and reclamation of certain refrigerants. However some issues vary considerably from one country to another, such as the different approaches taken to the avoidance of emissions, program organization and control, responsibility levels, regulatory legislation, financing arrangements, and operating procedures.

Different strategies are followed to achieve emission reductions. In some countries government and industry have collaborated and defined an obligatory preventive emission control regime. With this approach preventive measures are taken to improve the leak tightness of systems and avoid the occurrence of refrigerant leakage, rather than repairing leaking equipment after emissions have already happened. For example in The Netherlands a program operated by a private trade and industry organization (STEK) concentrates on preventive leakage control by focussing on technical improvements in the design and installation of equipment. This program is backed up by a quality control network to ensure competence of personnel and adequacy of reporting procedures. Some other ‘countries (e.g. France) operate programs that focus on refrigerant stewardship

measures to limit refrigerant emissions throughout the product life cycle, i.e. from production plant through to recovery, recycle, reclaim, and destruction processes.

Information is generally lacking on the issue of environmental and cost benefits occurring since the introduction of refrigerant R/R/R regulations, as no official before and after situation monitoring results have been reported to date. However, based on information from individual responses, published results on specific applications, and recent study data (e.g. France, Australia, The Netherlands) it is clear that these programs have proven to be effective so far in achieving significant reductions in refrigerant emissions. For example in The Netherlands, according to industry data, leakage rates there have reduced from about 30% of charge for some equipment in the early 1990s to an average annual level of 4.8% in 1999 (equivalent to 650 tonnes of refrigerant). In general, where information is clearly lacking, more studies are required to assess the environmental and cost impacts caused by the introduction of R/R/R programs in various countries. Another recommendation is the development of monitoring protocols to keep track of the volumes of refrigerant usage in various sectors in different countries, possibly based on the approach of the recent government sponsored study (NOKS 2001) conducted in The Netherlands.

One issue that may have a negative impact on future R/R/R activities in Europe is the regulation EC 2037/2000 which includes a ban on the use of CFCs for refilling purposes and the requirement for their destruction. The service industry in France has raised concerns that this may ultimately lead to wide scale venting of ODS in that country. Similar effects could be expected in other EU countries. It is recommended that a review be conducted within the next three years to assess the impact of this regulation and its potential for impeding the continuation of refrigerant R/R/R programs.

7. References

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