Responsible Use Guide for Minimizing Fluorocarbon Emissions in Manufacturing Facilities

The Air-Conditioning and Refrigeration Institute

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The information in this guide is based, in part, on a survey of the industry's plant facilities. The survey, sent to members of the Air-Conditioning and Refrigeration Institute (ARI), included not only HVACR equipment manufacturers but also refrigerant manufacturers. This guide relates specifically to fluorocarbons but many of the practices should be used for other refrigerants.

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Preface and Scope

The heating, ventilation, air-conditioning and refrigeration (HVACR) industry is committed to providing conditioned warm and cool air and refrigeration to improve the world's quality of life, health and productivity. The HVACR industry believes that a clean environment promotes well-being, and it is committed to carrying out its business in a sustainable fashion including minimizing emissions and continuing to contribute to both climate and ozone protection. This includes the responsible use of refrigerants, especially fluorocarbons, which allow HVACR equipment to fulfill its important roles.

The HVACR industry has a proud history of environmentally responsible use of refrigerants and it continues to improve an already good record of handling refrigerants. A 2005 industry survey showed that in the last ten years industry has made substantive expenditures to control refrigerant emissions; over 70 percent of the responders have reduced emissions between 25 and 75 percent. Over 50% of the responders have built new facilities with a zero emission goal.

The *Responsible Use Guide for Minimizing Fluorocarbon Emissions in Manufacturing Facilities* is one part of an evolving partnership between US EPA and ARI to minimize refrigerant emissions. The information in this publication relating to the manufacturing of residential and commercial equipment is intended for use in every HVACR or related facility where refrigerants are either produced, used, stored or transported. It may not be practical to implement all of these practices in every facility because of unique circumstances in some facilities; however they are recommended to be used wherever possible. The examples given herein of some current practices are for illustrative purposes, and are not intended to infer that they are the only methods to responsibly use fluorocarbons.

The information is provided to encourage refrigerant containment and environmental protection. This information is intended to be used, and typically is most successfully used, as part of a comprehensive program which includes design optimization, preventive maintenance, training, leak detection and testing, recovery and reclamation. Successful implementation of these recommendations will not only reduce emissions but can conserve refrigerant supply. ARI recognizes that these recommendations should result in measurable emissions reductions but this guide does not contain specific quantification methods.

None of the information contained herein is intended to supersede any applicable government regulations for storage, use, or handling of fluorocarbons, such as those contained in the US Clean Air Act. In addition to following all applicable government regulations, factories should follow all applicable industry standards for safety, design, installation, operation and maintenance of chemical blending tanks, holding tanks, dispensing equipment and ventilation.

Section 1:

Refrigerant Recovery

Refrigerant recovery is any process which removes and recovers refrigerants from a system for reuse, recycling, reclamation or proper disposal.

A. Recovery equipment should be available to all qualified (licensed, certified, or otherwise qualified) personnel in both manufacturing and testing laboratories.

B. All personnel using recovery equipment should be properly trained on applicable equipment and refrigerants.

C. Recovered refrigerant should be either reused, recycled, reclaimed or destroyed and appropriate records kept.

Section 2:

Operational practices for manufacturing, laboratories and plant air conditioning systems

This applies to both products developed at the plant and the plant's operations.

A. All process storage and plant air conditioning lines should be designed and installed to prevent both gradual and sudden refrigerant emissions.

Examples:
i.) braze and weld process and storage lines where possible
ii.) install plant air-conditioning lines and systems to prevent damage to piping and easy access for maintenance, repair, and recovery of refrigerants
iii.) protect or conceal piping where practicable

B. Use a process to detect and measure refrigerant loss during manufacturing.

Examples:
i.) maintain mass balance or plant inventory measurements
ii.) measure actual emissions where feasible and cost effective

C. Valves, seals, pumps, tanks, piping, etc should be designed to specifically prevent refrigerant emissions.

Examples:
i.) use low emitting valves or seal caps
ii.) use appropriately located isolation valves
iii.) recover refrigerant samples

D. Preventive maintenance should be used to ensure responsible practices and effectiveness of refrigerant handling equipment.

Examples: i.) routine maintenance practices which include emptying lines and use of recovery and/or disposal lines to prevent emissions
ii.) remove air or inert gases from systems before filling with refrigerant
iii.) ensure all associated instrumentation is properly calibrated

E. Practices and equipment should be designed to minimize refrigerant loss during equipment charging/startup.

Examples: i.) pressurize equipment and verify that pressure is held upon delivery
ii.) protect vulnerable components from shipping damage

F. Laboratory practices should limit emissions.

Examples: i.) recover/recycle/dispose laboratory refrigerant samples as appropriate
ii.) ensure personnel are trained and/or certified in safe handling and use of refrigerants
iii.) refrigeration/air-conditioning test models should be assembled and used with minimal/no emissions. Options include:
a.) assemble test models using a nitrogen purge for copper refrigerant piping to prevent refrigerant circulation/plugging
b.) check for test model leakage prior to refrigerant charging
c.) monitor test models for leaks during testing

Section 3:

Waste Handling

Waste handling is the recovery, collection, and disposal of wastes (solid, liquid or gas) containing fluorocarbons.

A. Waste refrigerants should be recovered and recycled if possible. Proper disposal, by incineration or other approved method, should be used when recycling is impractical.

B. Waste-containing refrigerants (including refrigerant oils) should be disposed of in an approved manner.

C. All waste handling equipment should be kept in proper working order and appropriate leak monitoring systems should be in place.

Section 4:

Storage

This applies to the storage of refrigerants in either bulk tanks or cylinders in the manufacturing facility.

All refrigerants must be stored in pressure vessels which comply with applicable federal, state, and local laws and regulations.

Section 5:

Equipment Shipment & Transportation

This applies to the relocation of finished equipment from manufacturing facilities to installation or warehouse sites.

A. Equipment charged with refrigerant should have initial and arrival pressures noted to determine any leakage. Any reported leakage should be followed-up with an internal quality assurance process, including corrective action if required.

Example: i) the equipment data plate should be clearly marked as a fully charged system. Include: weight of system charge, refrigerant type, date of manufacture

B. Equipment not charged with refrigerant should be shipped with inert gas to ensure system integrity, with initial and arrival pressures noted to determine any leakage. Any reported leakage should be followed-up with an internal quality assurance process, including corrective action if required.

C. Packaging should be designed to minimize refrigerant loss during shipping.

Examples: i.) bracing, restraining or clamping all equipment components subject to loading/unloading and/or transit vibration
ii.) appropriate shipping tests to prevent piping damage from vibration or contact with other system components

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