

Construction and Demolition

How to Properly Dispose of Refrigeration and Air-Conditioning Equipment

Whether you are on the job at a construction/demolition site or at a demolition scrapyard or recycling facility, you are likely to encounter refrigeration and air-conditioning (AC) equipment. Refrigeration/AC equipment has historically used refrigerants and/or insulating foam, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), which deplete the stratospheric ozone layer and contribute to global climate change. Newer refrigeration/AC equipment is likely to contain hydrofluorocarbons (HFCs), which are used as ozone-friendly substitutes for CFCs and HCFCs but still contribute to climate change. The types of CFC, HCFC, and HFC refrigerants commonly used in refrigeration/AC equipment are shown in Box 1.



This factsheet outlines the requirements established by the U.S. Environmental Protection Agency (EPA) regarding refrigerants, as well as tips on best practices for handling refrigerants and foams, to ensure that emissions of ozone-depleting substances (ODS) and their substitutes are minimized during the disposal of refrigeration/AC equipment by companies in the demolition/recycling industry.



What is Required by Law?

Under Section 608 of the Clean Air Act (CAA), EPA has established regulations (40 CFR Part 82, Subparts A and F) that are relevant to the disposal of refrigeration/AC equipment. These regulations specify:

1. A prohibition on intentionally venting ODS refrigerants and ODS substitutes into the atmosphere while disposing of refrigeration/AC equipment;
2. Certification requirements for refrigerant recovery equipment, as well as refrigerant evacuation requirements, to maximize recovery of ODS during the disposal of refrigeration/AC equipment;
3. Certification requirements for technicians disposing of refrigeration/AC equipment, *excluding small appliances* (see Box 4 on page 3);



Box 1. What Types of Refrigerants Are Typically Contained in Refrigeration/AC Equipment in the U.S.?

The refrigerants commonly found in refrigeration/AC equipment, as well as their approximate charge sizes, are listed in the table below. Actual equipment charge size varies based on equipment type and model. As shown, a household refrigerator typically contains 0.5 pounds of refrigerant, while a building chiller may contain over 1,000 pounds.

Typical Refrigerants and Charge Sizes Commonly Used in Refrigeration/AC Equipment

Equipment Type	Common Refrigerants	Charge Sizes (lb)
Chillers	CFC-11, CFC-12, HCFC-22, HCFC-123, HFC-134a, R-407C**	570 - 1,150
Cold Storage	CFC-12, R-502*, HCFC-22, R-404A	0.017 - 0.019/ft ²
Commercial Refrigeration	CFC-12, HCFC-22, R-404A, R-507A**	1,320 - 1,980
Dehumidifiers	HCFC-22, HFC-134a	0.4 - 0.5
Domestic Refrigerators & Freezers	CFC-12, HFC-134a	0.51
Ice Makers	CFC-12, HFC-134a	5.5 - 6.6
Industrial Refrigeration	CFC-11, CFC-12, HCFC-22, HCFC-123, HFC-134a, R-404A**	1,340 - 8,110
PTAC/PTHP	HCFC-22, R-410A**	1.3 - 1.5
Unitary AC	HCFC-22, R-410A	7.5 - 9.5
Window AC	HCFC-22, R-407C/410A	1.1 - 1.3

*Refrigerant blend containing HCFC-22 and CFC-115
** HFC blend

4. Safe disposal requirements for small appliances to ensure removal of refrigerants from goods that enter the waste stream with the refrigerant charge intact;
5. Recordkeeping requirements for persons disposing of refrigeration/AC equipment to certify to EPA that they have acquired refrigerant recovery equipment and are complying with the rule; and
6. Procedural requirements for sending refrigerant to a destruction or reclamation facility.

Box 2. Why Shouldn't I Just Vent Refrigerant?

1. It's illegal;
2. It's harmful to the environment and human health; and
3. You can earn money by selling recovered refrigerant to an EPA-certified refrigerant reclaimer.

How Do I Recover Refrigerant?

Section 608 of the CAA prohibits individuals from intentionally venting refrigerants into the atmosphere while disposing of refrigeration/AC equipment. “De minimis” quantities of refrigerant released in the course of making good faith attempts to recapture and recycle or safely dispose of refrigerant are not subject to this prohibition (§ 82.154[a][2]).



To implement the venting prohibition, Section 608 specifies evacuation level requirements (§ 82.156) and refrigerant recovery equipment requirements (§ 82.158) for both small appliances and other refrigeration/AC equipment.

Refrigerant Recovery Equipment Requirements

Persons involved in the disposal of refrigeration/AC equipment must certify to their EPA Regional Office that they have acquired (built, bought, or leased) and are properly using refrigerant recovery equipment certified by an EPA-approved equipment testing organization (see text box below). A sample form is available at www.epa.gov/Ozone/title6/608/recoveryform.pdf. This certification must be signed by the owner of the equipment or another responsible officer.

EPA-certified equipment meets the standards established in § 82.158 and is certified to be able to recover refrigerant from refrigeration/AC equipment according to the evacuation levels specified in § 82.156. These regulations specify evacuation levels for small appliances (§ 82.156[h]) and other equipment (§ 82.156[a]), dependent on the type, charge size, and date of manufacture of the equipment.

Box 3. EPA-Certified Recovery Equipment

EPA has approved two bodies to certify recycling and recovery equipment: the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and Underwriters Laboratories (UL).

Lists of certified equipment may be obtained by contacting ARI at 703-524-8800 and UL at 708-272-8800 ext. 42371. Certified equipment can be identified by a label reading: “*This equipment has been certified by ARI/UL to meet EPA’s minimum requirements for recycling and/ or recovery equipment intended for use with [appropriate category of appliance—e.g., HCFC appliances containing less than 200 pounds of refrigerant, all high-pressure appliances, etc.]*.”

Technician Certification Requirements

Technician certification is not required for individuals removing refrigerant from small appliances when preparing them for disposal. However, EPA certification is required for technicians who perform disposal of all other types of refrigeration/AC equipment (§ 82.161). EPA has developed four types of certification, two of which are applicable to technicians that dispose of refrigeration/AC equipment:

- **Type II** – For technicians dealing with high- or very high-pressure refrigeration/AC equipment (e.g., industrial process and cold storage equipment),¹ except small appliances; and
- **Type III** – For technicians dealing with low-pressure refrigeration/AC equipment (e.g., chillers).

To become certified under the mandatory program, technicians must pass an EPA-approved test given by an EPA-approved certifying organization. These certification credentials do not expire.

If no in-house certified technicians are available to perform refrigerant recovery from refrigeration/AC equipment other than small appliances at time of disposal, a company with certified technicians can be hired.

How Do I Safely Dispose of Small Appliances?

Small appliances are subject to special safe disposal requirements (§ 82.156[f]). Specifically, the final person in the disposal chain (e.g., recycler or landfill operator) is responsible to perform the following:

1. Recover any remaining refrigerant from the small appliance in accordance with the evacuation requirements for small appliances (§ 82.156[h]); or
2. Notify the suppliers of the small appliance(s) that the refrigerant must be properly removed before delivery to the facility²; and verify³ that the refrigerant has been evacuated from the appliance or shipment of appliances previously.

What Records Do I Need to Maintain?

Recordkeeping requirements have been established for persons disposing of small appliances and all other equipment (§ 82.166).

Small Appliances

Keep copies of signed statements collected in accordance with the Safe Disposal requirements on-site for at least three years.

All Other Equipment

Keep copies of technician certification at the technician’s place of business.

What Should I Do with Refrigerant Once it Has Been Recovered?

Once refrigerant is recovered, it may be destroyed, reclaimed for resale, or stored safely to prevent emissions, as illustrated in Figure 1.

Destruction

If you choose to send recovered ODS refrigerant for destruction, the ODS shipment must be sent to a destruction facility which uses one of the following destruction technologies (§ 82.3): liquid injection incineration, reactor cracking, gaseous/fume oxidation, rotary kiln incineration, cement kiln, or radio frequency plasma.



In addition, the ODS shipment must be sent to a destruction facility that achieves a destruction efficiency (DE)⁴ of 98%, as required under Title VI of the CAA; for ODS that are also Resource Conservation and Recovery Act (RCRA) hazardous wastes, the destruction facility must achieve a destruction and removal efficiency⁵ (DRE) of 99.99%, as required by RCRA and Title V of the Clean Air Act.

Reclamation

If you send recovered ODS refrigerant for reclamation, the ODS refrigerant shipment must be sent to an EPA-certified refrigerant reclaimer. You can view a list at www.epa.gov/ozone/title6/608/reclamation/reclist.

Box 4. Definitions

Small Appliance

A small appliance is defined as any appliance that is fully manufactured, charged, and hermetically sealed in a factory with five pounds or less of a CFC or HCFC refrigerant, including the following:

- Refrigerators and freezers (designed for home, commercial, or consumer use);
- Medical or industrial research refrigeration equipment;
- Room air conditioners (including window air conditioners and packaged terminal air heat pumps);
- Under-the-counter ice makers;
- Vending machines; and
- Drinking water coolers.

All Other Equipment

In this fact sheet, “all other equipment” refers to all appliances except for small appliances, motor vehicle air conditioners (MVACs), and MVAC-like* appliances. Specifically, this equipment includes:

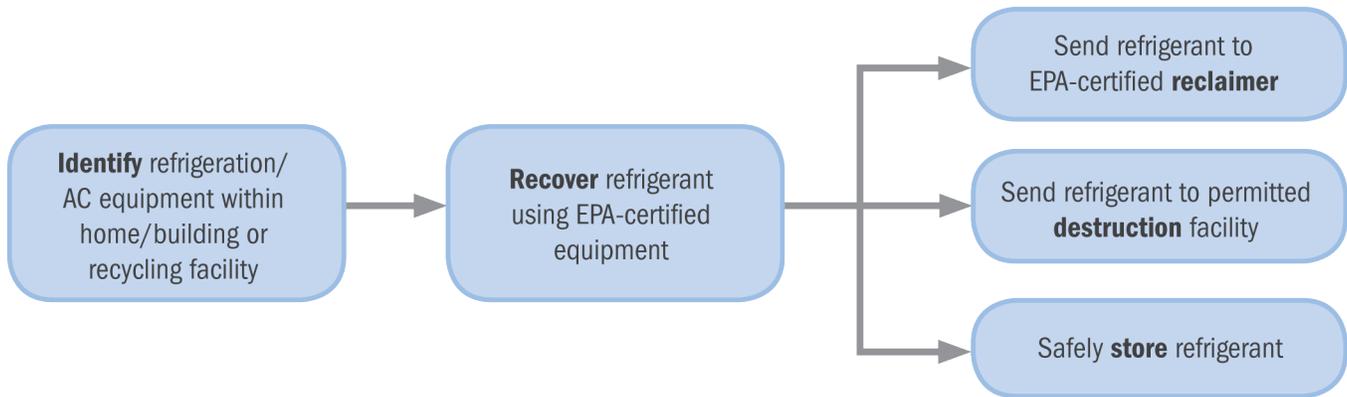
- Chillers;
- Industrial refrigeration equipment (not including research equipment);
- Commercial refrigeration equipment; and
- Cold storage equipment.

*An “MVAC-like appliance” has a refrigerant charge of 20 pounds or less and is used to cool the driver’s or passenger’s compartment of an off-road motor vehicle.

Box 5. What Happens to the Environment When Refrigerant or Blowing Agent is Released to the Atmosphere?

ODS refrigerant and blowing agents (CFCs and HCFCs) deplete the ozone layer and contribute to climate change. Ozone layer depletion allows more ultraviolet radiation, a human carcinogen, through our ozone layer, contributing to increased incidences of skin cancer, immune suppression, eye damage, and other skin problems in the general population. Climate change is associated with increased extreme weather events, rising sea levels, and thawing permafrost, among other major effects on the natural world. HFC blowing agents, which are used as substitutes for CFCs and HCFCs in newer equipment, do not deplete the ozone layer, but are potent greenhouse gases (GHGs).

Figure 1. Disposal Procedures for Refrigeration and Air-Conditioning Equipment



Going Beyond Requirements: Recovering ODS Foams

ODS blowing agents are used in insulating foam contained in commercial and domestic refrigerators and freezers, as well as in buildings (e.g., roofs, walls, floors, pipes, and storage tanks). Although not required by law, as a best practice, ODS foam can be recovered from refrigerators and freezers and buildings at time of demolition and sent for reclamation or destruction.

Foam Recovery from Buildings

Although there is limited experience to date in recovering and destroying foam insulation from buildings in the U.S., ODS foam recovery represents a significant opportunity for reducing emissions of ODS and GHGs. Technologies exist to recover ODS foam from buildings at time of demolition and either (a) send it for destruction (e.g., to a municipal solid waste incinerator or waste-to-energy boiler) or (b) send it for further processing to recover the blowing agent from the foam matrix and ultimately reclaim or destroy the concentrated blowing agent.⁶ The ability to extract foam-containing elements from demolition waste depends largely on the type and original form of the foam and how it was applied. Steel-faced sandwich panels—used in wall and roof insulation and for cold storage—and polyurethane boardstock foam—used in wall, roof, and floor insulation—may represent the greatest opportunities for ODS foam recovery and destruction.



Foam Recovery from Refrigerators and Freezers

CFC, HCFC, and HFC-containing foam has generally been used to insulate refrigerant-containing appliances, such as household and commercial refrigerators and freezers. To avoid the harmful release of ODS and GHGs, insulating foam should be removed from all parts of refrigerators and freezers at time of equipment disposal. Foam can be recovered from refrigerators and freezers either manually or through a fully automated process. Several dedicated appliance recycling facilities offer these types of foam removal and processing services across the U.S. In addition, EPA's voluntary Responsible Appliance Disposal (RAD) Program, designed to promote these types of best practices, serves as a technical clearinghouse on the development and implementation of responsible appliance disposal programs. For more information on appliance foam removal and the RAD Program, visit www.epa.gov/ozone/partnerships/rad.



How Can I Report a Violation?

EPA performs random inspections, responding to tips and pursuing potential cases against violators. Under the CAA, EPA is authorized to assess fines of up to \$37,500 per day for any violation of the regulations. Information on selected enforcement actions is available on EPA's website.

If you suspect or witness unlawful releases of refrigerant or other violations of the Clean Air Act regulations, you can file a report easily and anonymously by visiting EPA's Office of Enforcement and Compliance Assurance website at www.epa.gov/compliance/complaints/.

Where Can I Find More Information?

For more information concerning regulations related to stratospheric ozone protection visit:

www.epa.gov/ozone/strathome

Box 6. Where Would I Find ODS Foam in a Building?

ODS foam is commonly used in building roofs, walls, floors, pipes, and storage tanks as insulation material. ODS blowing agents are likely to be found in polyurethane (PU) rigid sandwich panels, PU and polyisocyanurate (PIR) rigid boardstock, PU rigid spray foam, and extruded polystyrene (XPS) foam boards.

¹ See § 82.152 for the definitions of high-, very high-, and low-pressure appliances.

² The form of this notification may be warning signs, letters to suppliers, or other equivalent means.

³ Such verification consists of a signed statement from the person from whom the appliance(s) is obtained that all refrigerant had been recovered from the small appliance(s) in compliance with the evacuation requirements for small appliances, as well as the name and address of the person who recovered the refrigerant and the date the refrigerant was recovered, or a contract that refrigerant will be removed prior to delivery.

⁴ DE is a measure of the comprehensiveness of destruction that includes emissions of undestroyed chemical from all points (e.g., stack gases, fly ash, scrubber, water, bottom ash).

⁵ DRE is a % that represents the number of molecules of a compound removed or destroyed in an incinerator relative to the number of molecules entering the system (e.g., a DRE of 99.99% means that 9,999 molecules are destroyed for every 10,000 that enter).

⁶ ODS sent for destruction must be sent to a destruction facility using an approved destruction technology, as listed on page 3.