



End-of-life Refrigerant Management Program

Report and Recommendations to the Legislature Pursuant to Engrossed Second Substitute House Bill 1050 (2021)

By

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For the

Air Quality Program

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Map of Counties Served



Southwest Region 360-407-6300	Northwest Region 206-594-0000	Central Region 509-575-2490	Eastern Region 509-329-3400
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Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
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DEPARTMENT OF
ECOLOGY
State of Washington

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Executive Summary

Many modern conveniences most of us rely on every day depend on the use of refrigerant chemicals. Air conditioners, refrigerators, freezers, automobile air conditioning systems, and heat pumps all use refrigerants to do their job. While these chemicals are highly effective at performing their intended purpose, they can also be dangerous to people and the environment. Some common refrigerants damage the Earth's ozone layer, and their replacements often are powerful greenhouse gases, thousands of times as powerful as carbon dioxide. All of these chemicals are relatively benign as long as they remain inside sealed systems. However, technicians must safely remove, handle, and recycle or dispose of these refrigerant chemicals when those systems need service or repair.

Used refrigerants are subject to both federal and state regulation under air quality and hazardous waste laws, all of which prohibit releasing these chemicals into the atmosphere. However, managing these used refrigerants can be time consuming and expensive for technicians servicing refrigeration equipment. The same goes for homeowners and commercial building owners needing to replace a failed or obsolete appliance or cooling system. Unfortunately, this can lead to illegal venting of refrigerants.

In 2021, the Legislature directed Ecology to provide recommendations "regarding the optimal design of a program to address the end-of-life management and disposal of refrigerants" and to solicit feedback from affected stakeholders. After conducting a stakeholder engagement process, Ecology has determined that a more extensive stakeholder process is needed in order to develop recommendations for an "optimal design" for an end-of-life refrigerant management program. While the stakeholder feedback received to date has been helpful and informative, it is clear there is not consensus among stakeholders regarding key program elements, such as scope and funding.

Based on stakeholder input, Ecology has already begun addressing some actions that can be pursued under current authority and resources and do not require a final program design, including:

- Amending the state's dangerous waste regulations to exclude hydrofluorocarbon (HFC) refrigerants from being dangerous waste when they are recycled, treating them the same as some other types of refrigerants.
- Expanding Ecology's outreach to businesses generating and reclaiming end-of-life refrigerants.
- Potentially reprioritizing Ecology's existing oversight and enforcement of current regulations.

Ecology recommends that an end-of-life refrigerant management program should be based on the following general principles:

- Address refrigerants as well as refrigerant-containing equipment and appliances (such as obsolete or failed refrigerators and air conditioners).

- Require management of used refrigerants according to the state’s current waste management hierarchy, prioritizing reuse, then recycle/reclamation, with destruction as a least-favored option.
- Have a designated entity for ongoing coordination and supervision of the program.
- Include provisions for all types of refrigerants, not just HFCs.
- Address unique needs and issues for tribal and local governments, especially those in rural locations, as it relates to end-of-life appliances.
- Address the needs of multiple participants, from manufacturers to end users.
- Require mandatory participation for manufacturers of refrigerants, manufacturers of equipment using refrigerants, service technicians, refrigerant sellers and distributors, and regulated equipment owners.
- Encourage homeowners and other non-regulated equipment owners to participate and make it easy for them to do so.
- Work with stakeholders to investigate the possibility of replacement incentives or rebates.
- Incorporate and publicize best practices as part of an outreach and education effort.
- Ensure fees are based at least in part on a refrigerant’s global warming potential.
- Have performance goals focused on reducing releases of refrigerants.

Although overarching program components had good support among stakeholders, we believe additional work remains to further refine these issues. When resources are available, additional stakeholder work could develop specific program elements based on these general guidelines and would help resolve uncertainties and discrepancies between various stakeholder positions. Ecology’s current resources are fully dedicated to implementing other aspects of Engrossed Second Substitute House Bill 1050.

Introduction

Legislative directive

In 2021, the Legislature adopted Engrossed Second Substitute House Bill 1050. Among many other statutory changes made by the bill (chapter 315, Laws of 2021), section 14 of that legislation requires the Department of Ecology (Ecology) to:

- (1) By December 1, 2021, the department of ecology must provide recommendations to the appropriate committees of the house of representatives and the senate regarding the optimal design of a program to address the end-of-life management and disposal of refrigerants including, but not limited to, ozone-depleting substances and hydrofluorocarbons. In developing the recommendations, the department must solicit feedback from potentially impacted parties and the public, and must consider actions taken by other jurisdictions to incentivize refrigerant reuse or reclamation. The recommendations may come in the form of draft legislation.
- (2) The recommendations must specifically include, at minimum, the following program design considerations:
 - (a) The legal and financial obligations to support or participate in the program applicable to refrigerant manufacturers, importers, distributors, and retailers, and to refrigerant-using equipment owner-operators and service technicians;
 - (b) A funding mechanism for refrigerant recovery and disposal activities carried out by the program that will also provide a financial incentive for the recovery and emission-reducing management of refrigerants that are no longer of utility to a consumer; and
 - (c) Performance goals and operational standards for activities carried out by the program to collect, transport, and recycle, reuse, or dispose of refrigerants.

This report only addresses issues related to section 14 of the underlying legislation. Other legislative provisions will be addressed separately.

“End-of-life”

When considering a program to address end-of-life refrigerants, it is important to note that “end-of-life” may be a misnomer. Refrigerant chemicals are, at least in theory, infinitely reusable unless they are irreversibly contaminated. Refrigeration systems work by changing the state of the refrigerant chemical from a liquid to a gas and back again—they do not consume refrigerants during this process.²

For purposes of this report, we use the phrase “end-of-life refrigerants” to mean refrigerants that can no longer be used for their initial purpose. This may be for functional reasons (such as the refrigerant is contaminated) or legal reasons (such as federal prohibitions on the use of

² Environmental Investigation Agency’s report “Search Reuse and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem” has more information about refrigerants and refrigerant lifecycle. https://content.eia-global.org/posts/documents/000/000/829/original/EIARreport_100billiontonclimateopportunity.pdf?1550165022.

refrigerants including R134a, R410A, and R407C starting in 2024³). They may subsequently be reused, reclaimed, recycled, or sent for destruction. This phrase does not solely refer to refrigerants that can never be repurposed in some way in the future (although some end-of-life refrigerants do fall into that category).

Refrigerant lifecycle

Understanding the lifecycle of refrigerant chemicals is important because choices made at various points in that cycle affect management of refrigerants and equipment at the end of their useful life.

Step one: product design

Initially, a manufacturer will design a product that uses refrigerants. Engineering specifications (such as system pressure) for that product will dictate which refrigerant(s) meet the manufacturer's needs. These specifications limit the substitution of one refrigerant for another.

Step two: product installation and use

After the manufacturer designs and produces the product, the customer buys and uses the product. Professional installation may be necessary, depending on the product.

During the life of product, technicians may need to maintain and service the product. This can include leak detection, repair, and refilling of refrigerant. For some products, the product owner may do their own maintenance and service repairs, including refilling of refrigerants (still common in some auto air conditioning systems, although not a best practice and partially restricted in Washington State⁴). Most modern home appliances do not require routine refrigerant maintenance.

Step three: refrigerant recovery

When service is needed, some products may require that a technician drain the refrigerant from the system before performing maintenance. In these cases, the service provider recovers (collects) the refrigerant from the equipment and stores it in a portable container. The refrigerant may or may not be contaminated with other substances, such as lubricating oils or water. The technician makes the repairs, refills the system with new refrigerants, and documents the work performed, including the amount of refrigerants drained and replaced. In the case of discarded equipment or appliances, a service provider must drain and collect the refrigerant in a similar manner before disposal of the appliance or equipment.

Step four: refrigerant consolidation

Some service technicians, refrigeration contractors, and refrigerant distributors can collect containers of recovered refrigerant, and may consolidate smaller containers into a larger

³ <https://heatpumpingtechnologies.org/us-epa-confirms-future-restrictions-on-high-gwp-refrigerants/>.

⁴ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.60.080>.

storage tank. This allows the refrigerant to be stored until it is ready for transport to a reclaimer or other proper disposal facility.

Step five: refrigerant reclamation and destruction

Most recovered refrigerants can be reclaimed by reprocessing the materials to remove impurities such as lubricating oils or water. While single-component and more simple refrigerants may be easier to reclaim, it is also possible to reclaim more complex blends of refrigerants. The Air Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 700 establishes the minimum purity required for reclaimed refrigerants. For most, volatile impurities must generally be less than 0.5 percent and water content must be less than ten parts per million.⁵

Washington State has two refrigerant reclaimers certified by the U.S. Environmental Protection Agency (EPA): Total Reclaim, Inc. in Kent and Valley Reclaim in Bremerton.⁶ An additional company, Rapid Recovery in Seattle, is not on EPA's list of reclaimers but their website notes they are owned by A-Gas, which is on the list as a certified reclaimer.

Some refrigerants may be too costly to reclaim. In other cases, their further use may be prohibited by law. In Washington State, refrigerants that cannot be reclaimed must be sent for proper disposal as dangerous waste. At present, the closest facility that can properly handle this waste stream is a permitted hazardous waste incinerator in Utah.⁷

Step six: refrigerant resale and reuse

After reclamation, refrigerants can be reused in any appropriate refrigeration system. This is especially important for refrigerants where import and production have been phased-out. These reclaimed refrigerants are necessary in older systems where it is not possible to retrofit or adapt the system to use newer refrigerants. Stakeholders informed Ecology that the market for older refrigerants is robust, with some types of refrigerants having a very high market value.

Evolution of refrigerant chemicals

Chlorofluorocarbons and hydrochlorofluorocarbons

Many modern conveniences, including air conditioners, refrigerators, freezers, and automobiles, use refrigerants that can be dangerous to people and the environment. Colloquially known by the DuPont Company's tradename "Freon," early popular refrigerants were chemicals known as chlorofluorocarbons (CFCs) and contained chlorine, fluorine, and carbon. Introduced in the 1930s, these chemicals replaced earlier refrigerants that were toxic.

⁵ https://ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_700_2019.pdf.

⁶ <https://www.epa.gov/section608/epa-certified-refrigerant-reclaimers>.

⁷ <http://ehso.com/tsdfincin.php>.

CFCs were versatile chemicals. They are purported to be nontoxic⁸ and nonflammable, which made them excellent choices in the manufacturing of “aerosol sprays, blowing agents for foams and packing materials, as solvents, and as refrigerants.”⁹

Developed as a second generation after CFCs, hydrochlorofluorocarbons (HCFCs) appeared as early as the 1940s. “Several HCFC solutions, usually blends, were designed to be used as simple and direct drop-in conversions for existing equipment that used CFC” refrigerants.¹⁰ HCFCs contain the same elements as CFCs, but additionally contain hydrogen as well.

Unfortunately, the chlorine in CFCs and HCFCs reacts with other substances in the atmosphere when the chemicals are released, causing damage to the ozone layer—the layer of gases high in the atmosphere that shield us from many of the sun’s harmful rays. CFCs and HCFCs are very long-lived and may persist in the atmosphere for hundreds of years. Along with damaging the ozone layer, these chemicals are also powerful greenhouse gases, some of which are more than 10,000 times more powerful than carbon dioxide in terms of global warming potential (GWP). This means every ton of a greenhouse gas with a GWP of 10,000 warms the planet as much as 10,000 tons of carbon dioxide.

To address degradation of the ozone layer, the international community adopted the Montreal Protocol in 1987. This international treaty required reductions and eventual phase out of production and consumption of CFCs and other ozone-depleting substances (ODS). At that time, HCFCs were generally seen as a readily available substitute, since the presence of hydrogen in these chemicals makes HCFCs less destructive to the ozone layer than CFCs. This substitution was to be temporary, as the Montreal Protocol also called for a long-term phase-out of HCFCs. In 2007, the Montreal Protocol was amended to accelerate the phase-out of HCFCs by 2020 in developed countries and by 2030 in developing countries.

It is important to note that the Montreal Protocol did not phase out equipment that uses CFC or HCFC refrigerants. Recycling and reclamation of these refrigerants provides the needed supply of these legacy chemicals for existing equipment.

Hydrofluorocarbons

In response to the Montreal Protocol, manufacturers turned to newly developed chemical compounds and natural alternatives. Manufacturers designed these new compounds—hydrofluorocarbons (HFCs)—to be less harmful to the Earth's protective ozone layer. However, they are still powerful greenhouse gases that contribute to climate change.

HFCs consist of hydrogen, fluorine, and carbon. This makes them similar to CFCs and HCFCs, but they lack the chlorine that causes ozone depletion. Like their predecessors, they are used in air

⁸ While the CFC itself may be nontoxic, the manufacturing process historically involved two chemicals as feedstock that are highly toxic—carbon tetrachloride and chloroform—both of which could end up in the final CFC product. See, e.g., <https://www.sciencedirect.com/topics/medicine-and-dentistry/chlorofluorohydrocarbon> and <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/carbon-tetrachloride>.

⁹ Chlorofluorocarbons (CFCs). The Chapman & Hall Encyclopedia of Environmental Science, pp. 78-80 (1999).

¹⁰ <https://gas-servei.com/en/products/refrigerants/hcfc-refrigerants/>.

conditioning and refrigeration products, in producing insulating foams, and as propellants in aerosol products. Although HFCs make up only a small percent of total greenhouse gas emissions, both in Washington and globally, HFCs are hundreds to tens of thousands of times more powerful in warming the planet than carbon dioxide and their use is increasing globally.¹¹ If their use is not curbed, experts estimate HFC emissions will increase from around one percent of global greenhouse gas emissions today to between 7–19 percent of global greenhouse gas emissions by 2050.¹²

Ecology estimates HFCs in Washington contribute about four million metric tons of greenhouse gases (carbon dioxide equivalent, or CO₂e) per year.¹³ Though this is a relatively small portion of total statewide emissions, emissions from HFCs in Washington will likely grow by at least a third over the next 15 years in the absence of policy action. The easiest way to understand how those emissions occur, and where they come from, is to focus on the end uses of HFCs. Figure 1 shows the emissions proportion for each individual end use.

¹¹ United Nations Environment Programme and International Energy Agency (2020). *Cooling Emissions and Policy Synthesis Report*. UNEP, Nairobi and IEA, Paris.

¹² Environmental Investigation Agency, 2015. <https://eia-global.org/campaigns/Climate/what-are-hydrofluorocarbons>

¹³ <https://ecology.wa.gov/Air-Climate/Climate-change/Greenhouse-gases/Greenhouse-gas-reporting/Inventories>

Washington State HFC Emissions by Source in millions of metric tons of greenhouse gases in CO₂e (assuming no effects from policy changes or other actions)

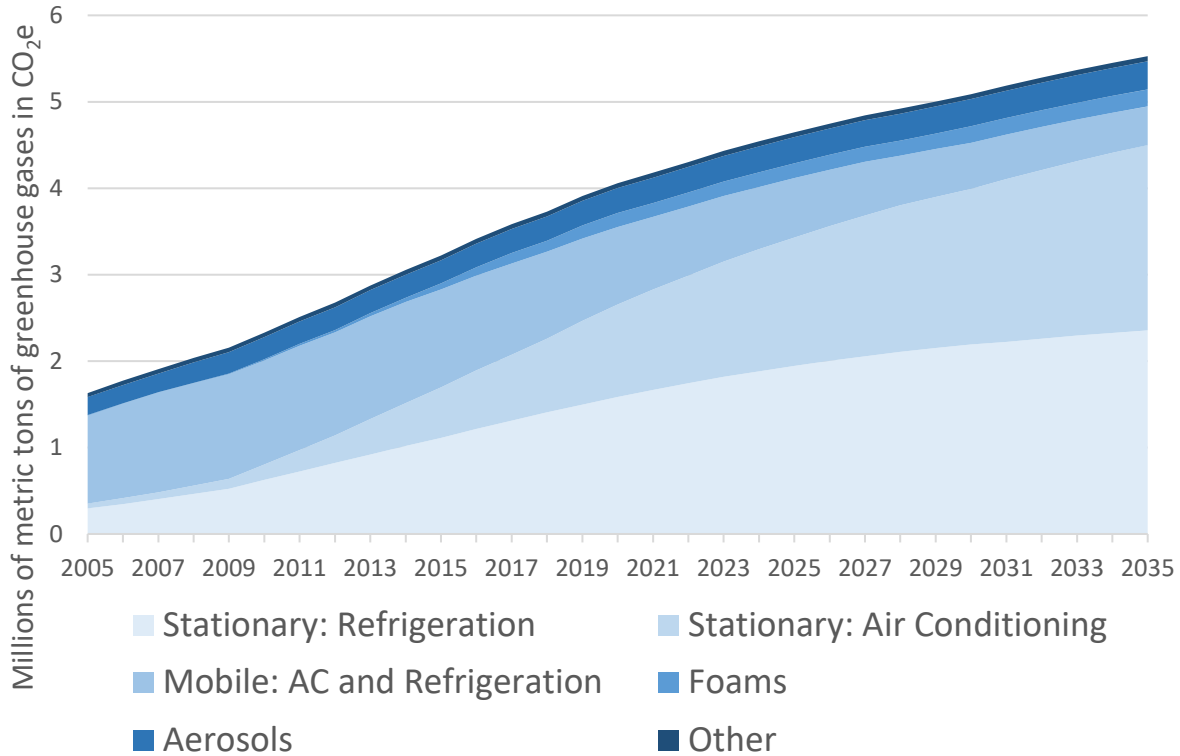


Figure 1: Estimated Washington HFC Emissions by Category (with no policy action¹⁴)

In 2016, the Montreal Protocol was amended again, this time to add HFCs. Known as the Kigali Amendment, this change to the Montreal Protocol “will reduce the projected production and consumption of hydrofluorocarbons (HFCs) by more than 80 per cent [*sic*] over the next 30 years.”¹⁵ The amendment requires a phase out in the production and use of HFCs, similar to how the original Montreal Protocol addressed CFCs and HCFCs.

Replacement refrigerants

Due to engineering requirements, replacement refrigerants may not be compatible with existing equipment. Instead, during the useful life of that equipment, system owners will either need to replenish systems with reclaimed refrigerants, convert systems to use non-HFC

¹⁴ The statement “without policy action” means a business-as-usual scenario where no policy action, including the effects of adopted legislation, is assumed to be in place.

¹⁵ <https://www.unep.org/news-and-stories/press-release/world-takes-stand-against-powerful-greenhouse-gases-implementation>.

refrigerants (although this is not always technologically possible), or replace outdated systems with new equipment that uses safer refrigerants.

The European Union classifies replacement refrigerants in four categories:¹⁶

- Natural refrigerants, such as propane, ammonia, and carbon dioxide.
- HFCs with lower GWP, such as R-32.
- Hydrofluoroolefins (HFOs).
- HFC-HFO blends.

While these replacement refrigerants may have lower impacts on climate and no effect on the ozone layer, they are not without challenges. Some, like ammonia, are corrosive and may be toxic if inhaled. Others, like propane, are flammable and can cause frostbite if workers are improperly exposed to the concentrated gas. However, industry has addressed these challenges in large-scale systems for many years. As an example, ammonia is the dominant refrigerant used in large-scale commercial food storage facilities and is frequently used at ice rinks.

Equipment disposal issues

Although the Legislature directed Ecology to address “end-of-life refrigerant” management, end-of-life refrigerant-containing equipment management is also an issue. When refrigerators, freezers, and window air conditioning units are beyond repair, they ultimately become the responsibility of city, county, and tribal governments as part of the solid waste stream. This can be because the local or tribal authority provides municipal waste services or because of illegal dumping of waste appliances.

A November 17, 2020 [briefing paper](#) for the Yolo County, California Board of Supervisors addressed a report on illegal dumping eradication programs and related appliance recycling by the county’s Division of Integrated Waste Management (DIWM).

On the policy front at the State level, the California Product Stewardship Council (CPSC) is working to get an Extended Producer Responsibility (EPR) bill written and passed through the State Assembly which puts a recycling fee on all appliances sold. This would mirror the Covered Electronic Waste (television and computer monitor) as well as the mattress recycling EPR programs which allows funding to come back to Yolo County to accept these items free of charge from the public and support “cradle to grave” recycling for all Californians. This is an important effort for Yolo County, for as explained further below, **the current regulatory cost of disposing these appliances far exceeds the fees charged for their disposal**. DIWM staff anticipate bringing a draft bill to the Board in late 2021, at which point we will be seeking a letter of support for such legislative action.

Until such time as an EPR is in place, the DIWM continues to accept, process and recycle over 12,000 appliances annually at the Yolo County Central Landfill. Due to increased enforcement by the Department of Toxic Substances and Control (DTSC) on air quality regulations and hazardous waste storage limits, appliance recyclers will no longer pick up appliances at the landfill without

¹⁶ https://ec.europa.eu/clima/policies/f-gas/alternatives_en.

the units first being serviced (emptied of all hazardous waste such as Freon, batteries, circuit boards, capacitors, gear oil, etc.). **This has resulted in a \$125,000 annual increase in costs to the DIWM with no current means to recoup these costs. The cost to service an appliance averages an additional \$10/unit on top of our current \$6/unit charge.** Due to staging required to service these appliances, DIWM also has increased its cost per unit in labor. (*Emphasis added.*)¹⁷

Although not all local governments are comparable to Yolo County, this information is relevant to a potential program in Washington. Tribal and local governments across Washington face similar problems as Yolo County. Ecology received anecdotal information from local government solid waste programs indicating that recycling these appliances can be quite costly. While specific costs they incur may differ, each jurisdiction faces similar problems related to waste appliances containing end-of-life refrigerants. Additionally, stakeholders informed Ecology that in some areas of the state there may not be a local outlet to take used refrigerant, resulting in costs to transport appliances long distances for recycling. Even though the appliances may have scrap metal value, it may not be enough to offset the costs currently being incurred.

¹⁷ https://yoloagenda.yolocounty.org/agenda_publish.cfm?id=&mt=BOS&get_month=11&get_year=2020&dsp=agm&seq=10305&rev=0&ag=3173&ln=93286&nseq=&nrev=&pseq=10295&prev=0#ReturnTo93286.

Applicable Treaties, Laws, and Regulations

Treaties

Montreal Protocol

As noted above, the Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty ratified by every country on Earth. The protocol regulates the production and use of nearly 100 chemicals that harm the Earth's ozone layer. These ODS chemicals most notably include CFCs and HCFCs, as well as some related chemicals like halons.¹⁸ The international community adopted the Montreal Protocol in 1987, and the United States Senate voted to ratify the treaty in 1988.¹⁹

Kigali Amendment

The Montreal Protocol was amended in 2016 to require reductions in the production and use of HFCs on a specified timeline under the Kigali Amendment. Industrialized nations like the United States must reduce their use of HFCs at a faster rate than developing countries.²⁰ Signatories agree to reduce overall HFC use by 80–85 percent of each country's baseline amount by 2040.

Because the Montreal Protocol is an international treaty, the Kigali Amendment is also subject to ratification by the Senate. While the United States signed the amendment in 2016, it was not ratified at that time. The amendment was sent to the Senate for ratification on November 16, 2021.²¹

Federal laws and regulations

Clean Air Act and implementing regulations

EPA regulations adopted under Section 601–607 of the federal [Clean Air Act \(CAA\)](#)²² require the phase out of the production and import of ODS, such as CFCs and HCFCs, in schedules consistent with the Montreal Protocol. Section 608 of the CAA establishes the National Recycling and Emission Reduction Program, which addresses the handling and recycling of ODS used in stationary refrigeration, air conditioning, and heat pump equipment.

The purpose of these regulations is to reduce the amount of ODS in the atmosphere by prohibiting their intentional release, reducing their overall use, maximizing their recapture and recycling, and ensuring their safe disposal. These regulations address the following areas:

¹⁸ <https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol>.

¹⁹ <https://www.state.gov/key-topics-office-of-environmental-quality-and-transboundary-issues/the-montreal-protocol-on-substances-that-deplete-the-ozone-layer/>.

²⁰ <https://crsreports.congress.gov/product/pdf/IF/IF11779>.

²¹ <https://www.reuters.com/business/cop/white-house-send-kigali-amendment-climate-warming-gases-senate-officials-2021-11-16/>.

²² See <https://www.epa.gov/clean-air-act-overview/clean-air-act-title-vi-stratospheric-ozone-protection> for links to the rules under each CAA section.

- Refrigerant leaks: Equipment using 50 or more pounds of refrigerant is subject to specific requirements for leak repair and reporting to EPA when leaks are substantial.
- Sales restrictions: Refrigerants can only be sold to technicians who are EPA-certified.
- Record keeping: Service technicians, owners and operators of large equipment, and refrigerant wholesalers and reclaimers must document activities involving refrigerant recharge and disposal.
- Safe disposal: The final person in the disposal chain must ensure refrigerants are removed from the equipment.
- Reclamation: Recovered refrigerant must meet specified purity levels before resale.
- Service practices: Technicians must evacuate refrigerant to established vacuum levels during servicing of equipment.
- Technician certification: Technicians servicing refrigeration and air conditioning equipment must obtain EPA certification.
- Refrigerant recovery and recycling: Reclamation equipment must be certified by an EPA-approved testing organization.

Significant New Alternatives Policy program

The Significant New Alternatives Policy (SNAP) program implements Section 612 of the CAA. This provision requires EPA to evaluate substitutes for ODS to reduce risk to human health and the environment.²³ Under the program, EPA identifies and reviews substitutes, including HFCs, used in industrial sectors that predominately use ODS. EPA then publishes lists of acceptable and unacceptable substitutes by end-use within each sector. The determinations are based on characteristics such as:

- Ozone depleting potential.
- Global warming potential.
- Toxicity.
- Flammability.
- Occupational and consumer health safety.
- Local air quality.
- Ecosystem effects.

The determinations include findings of “acceptable,” “acceptable subject to use conditions,” “acceptable subject to narrowed use limits,” and “unacceptable.”

- Substitutes found to be “acceptable” are published in a *Notice of Acceptability* or *Notice*. These findings do not require a public notice and comment period.

²³ <https://www.epa.gov/snap/snap-regulations>.

- Substitutes found to be “acceptable subject to use conditions,” “acceptable subject to narrowed use limits,” or “unacceptable” are subject to public notice and comment period on a proposed rule, after which EPA promulgates a final rule.

2020 American Innovation and Manufacturing Act

Passed in late 2020, the [American Innovation and Manufacturing \(AIM\) Act](#)²⁴ includes provisions that direct EPA to address HFCs by taking action in three main regulatory areas:

- Phase down of both production and consumption of HFCs by establishing an allocation and trading program.
- Facilitate transitions to next generation technologies by adopting restrictions on specific HFC uses.
- Manage HFCs and their substitutes by adopting regulations on the service, repair, and disposal of HFC-containing equipment.

EPA issued the first proposed rule under the AIM Act on May 19, 2021, summarizing the proposed action:

In this rulemaking, EPA is proposing to: Establish the HFC production and consumption baselines based on historical data; establish the allowance allocation program to phase down HFC production and consumption; determine an initial approach to allocating calendar-year allowances and allowing for the transfer of those allowances; establish provisions for the international transfer of allowances; establish recordkeeping and reporting requirements; release certain data to provide transparency and support implementation of the program; and, address certain other elements related to the effective implementation of the AIM Act.²⁵

The Congressional Research Service reports that, “AIM’s phasedown schedule appears to align with international commitments to phase down HFCs under the Kigali Amendment to the Montreal Protocol.”²⁶ The EPA issued a final rule September 23, 2021.²⁷

Resource Conservation and Recovery Act

Federal laws governing the handling of hazardous waste are administered under the Resource Conservation and Recovery Act (RCRA). The law’s [implementing regulations](#)²⁸ outline standards for determining if a solid waste is also a hazardous waste once it can no longer be used for its original purpose. The law only applies to solid wastes; it does not regulate hazardous substances or products. RCRA covers solid wastes that are toxic, flammable, corrosive, or reactive and specifically lists a number of regulated wastes (known as listed wastes). It is

²⁴ <https://www.epa.gov/climate-hfcs-reduction/aim-act>.

²⁵ <https://www.federalregister.gov/documents/2021/05/19/2021-09545/phasedown-of-hydrofluorocarbons-establishing-the-allowance-allocation-and-trading-program-under-the>.

²⁶ <https://crsreports.congress.gov/product/pdf/IF/IF11779>.

²⁷ <https://www.epa.gov/newsreleases/us-will-dramatically-cut-climate-damaging-greenhouse-gases-new-program-aimed-chemicals>

²⁸ Generally, 40 CFR Parts 260–268. <https://ecfr.federalregister.gov/current/title-40/chapter-I/subchapter-I>.

important to note that the phrase “solid” waste includes liquids and compressed gases. Non-compressed gases are not solid waste and therefore are not hazardous waste.

In 1991, EPA promulgated rules allowing CFC refrigerants to be excluded from being a solid waste if they were reclaimed for reuse. CFC refrigerants that are excluded from being solid waste are consequently also not hazardous waste, even if they otherwise would be. This exclusion is significant because it results in CFC reclaimers not being required to follow many of the regulations governing hazardous waste facilities. EPA explained its reasoning for this approach as:

Thus, the equipment servicer who must remove the chlorofluorocarbon refrigerants in order to service the equipment must decide whether to vent them (and thus avoid hazardous waste regulatory requirements) or collect them and possibly be required to manage them as hazardous wastes. EPA is concerned that, if the refrigerants are regulated as hazardous wastes, most servicers will vent the material rather than collect it for recycling.²⁹

This exclusion applies to:

(12) Used chlorofluorocarbon refrigerants from totally enclosed heat transfer equipment, including mobile air conditioning systems, mobile refrigeration, and commercial and industrial air conditioning and refrigeration systems that use chlorofluorocarbons as the heat transfer fluid in a refrigeration cycle, provided the refrigerant is reclaimed for further use.³⁰

Eventually, EPA officially recognized HCFCs as being CFCs for purposes of the exclusion, but also specifically found:

Since HFCs are not “chlorofluorocarbons,” they are not eligible for the 40 CFR 261.4(b)(12) exclusion.³¹

The exclusion took effect at the federal level on February 5, 1991. The exclusion only applies to those refrigerants being reclaimed and recycled for reuse. The exclusion does not apply to CFCs and HCFCs sent for disposal, which means those substances may be hazardous waste.

Improper disposal of regulated waste refrigerants, including gaseous releases to the environment, is a violation of RCRA requirements. However, RCRA applies to businesses, governments, universities, and other entities, not individual homeowners or the general public. The federal regulations also exempt some businesses from most of the requirements under limited circumstances.

²⁹ 56 FR 5911, February 13, 1991. <https://www.govinfo.gov/content/pkg/FR-1991-02-13/pdf/FR-1991-02-13.pdf>.

³⁰ 40 CFR 261.4(b)(12).

³¹ EPA Faxback 14323, August 22, 1994. <https://rcrapublic.epa.gov/files/14323.pdf>.

Washington State laws and regulations

Chapter 70A.15 RCW

The Washington Clean Air Act (Washington CAA), [Chapter 70A.15 RCW](#),³² has regulated ODS since 1991 and establishes ODS restrictions that are similar to those in the federal CAA. The law:

- Prohibits the intentional release of ODS refrigerants into the atmosphere.
- Requires persons repairing or disposing of equipment containing ODS refrigerants to use refrigerant extraction equipment.
- Prohibits the sale or purchase of certain nonessential consumer products containing ODS (such as party streamers, tire inflators, and air horns).
- Prohibits the sale or purchase of ODS refrigerants in containers designed for consumer recharge of motor vehicle air conditioning and consumer appliances.

In 2021, the Washington Legislature passed new HFC legislation, Chapter 315, Laws of 2021. In addition to other restrictions, the 2021 legislation added HFCs to the existing requirements for ODS and removed previously existing exceptions for off-road commercial and agricultural equipment.

Chapter 70A.45 RCW and Chapter 70A.60 RCW

To address reductions in greenhouse gas emissions, in 2008 the Washington Legislature adopted Chapter 70.235 RCW, which was later amended and recodified as [Chapter 70A.45 RCW](#).³³ Although this statute did not address refrigerants specifically, it did provide for limits on emissions of greenhouse gases from all sources.

In 2019, the Legislature passed Engrossed Second Substitute House Bill 1112 (codified at RCW 70A.45.080, then later recodified as [RCW 70A.60.060](#),³⁴) which required a transition away from many major uses of HFCs. This law imposed state restrictions to replace EPA's SNAP rules 20 and 21. These SNAP rules had been in place since 2015 and 2016, respectively, but were partially vacated by the United States D.C. Circuit Court of Appeals in 2017 and 2019. RCW 70A.60.060 eliminated or limited the use of HFCs in a variety of products and equipment sold in Washington and required manufacturers to label their HFC-containing products. Products and equipment affected by the law include residential and commercial refrigeration equipment, some commercial cooling technologies, a variety of foam products, and a small number of aerosol propellants. The restrictions phase in over five years, starting January 1, 2020 for the first set of products. On December 10, 2020, Ecology adopted final rules to clarify

³² <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.15>.

³³ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.45>.

³⁴ <https://app.leg.wa.gov/rcw/default.aspx?cite=70A.60.060>.

implementation details and align requirements with existing industry practices and the HFC regulations of other states.

Chapters 70A.300 RCW and 173-303 WAC

Washington's dangerous waste regulations, [Chapter 173-303 WAC](#),³⁵ are the implementing rules for [Chapter 70A.300 RCW](#),³⁶ Washington's state RCRA equivalent. Ecology is the designated "authorized program" for EPA and the federal hazardous waste laws in Washington. This means Washington's dangerous waste regulations are the vehicle for implementing RCRA.

As an authorized program, Ecology may adopt additional or more stringent requirements than the federal rules, but no state regulation may be less stringent than its federal counterpart. Washington has chosen to regulate a few types of waste slightly differently than under RCRA. The additional Washington requirements that are applicable to refrigerants are:

- Toxic wastes are regulated on actual toxicity, not merely the presence of a waste on a federal list of toxic chemicals. The CFC refrigerant R-12, is a listed federal hazardous waste.³⁷ Other refrigerants may also qualify as toxic waste under the dangerous waste regulations.
- Wastes that are halogenated organic compounds (HOCs) and which last in the environment for more than one year are regulated as "persistent" wastes. Although we have not individually evaluated all refrigerants on the market, it appears that all CFCs, HCFCs, and HFCs would be persistent waste under the dangerous waste regulations. At present, RCRA does not regulate HOCs based on persistence.

To distinguish between state and federal requirements, the phrase "hazardous waste" refers to federal regulations and "dangerous waste" refers to state requirements. All "hazardous waste" is also "dangerous waste," but some limited examples of "dangerous waste" are not federal hazardous waste.

To maintain consistency with federal RCRA regulations, Ecology adopted a state regulation to exclude CFCs and HCFCs from the definition of solid waste when they are sent for recycling, resulting in them no longer being dangerous waste. Ecology filed [WAC 173-303-506](#)³⁸ January 5, 1993 with an effective date of February 5, 1993.³⁹ The final rule was adopted October 19, 1995. Unlike its federal counterpart, Washington's regulation overtly lists both CFCs and HCFCs in the regulation.⁴⁰

As with the federal regulations, the dangerous waste regulations apply to businesses, governments, universities, and other entities but not to the general public and homeowners.

³⁵ <https://app.leg.wa.gov/WAC/default.aspx?cite=173-303>.

³⁶ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.300>.

³⁷ Dichlorodifluoromethane is a RCRA listed waste under code U075. It and other halogenated refrigerants may also be subject to reporting under RCRA codes F001 or F002.

³⁸ <https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-506>.

³⁹ Washington State Register 93-02-049. <http://lawfilesexternal.wa.gov/law/wsr/1978-1996/93-02.pdf>.

⁴⁰ 40 CFR 261.4(b)(12).

Some small businesses may also be exempt from most of the dangerous waste regulations if they follow [a few basic requirements](#).⁴¹

⁴¹ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Dangerous-waste-guidance/Dangerous-waste-basics/Small-quantity-generators>.

Elements of End-of-life Refrigerant Management Programs in Other Jurisdictions

As directed by the Legislature, Ecology researched end-of-life refrigerant management programs from other jurisdictions to identify key elements and considerations for development of a program in Washington. We conducted research on-line via program websites, through telephone interviews, and email exchanges with program administrators. Due to time constraints, the programs discussed in this report only represent a sample of the programs researched and a small sample of the various programs in existence. In addition to examining how refrigerants are currently managed by non-state entities in Washington, Ecology investigated programs in California, New York City, British Columbia, Australia, and the European Union.

Primary program issues identified

Based on research and comments received from stakeholders, the primary considerations for research were determining the program scope, funding, and management authority of an end-of-life refrigerant management program. Other important factors include:

- **Refrigerant versus refrigerant-containing appliance.** Some programs focus solely on the collection and management of the refrigerants themselves, while others focus more broadly on the collection of refrigerant-containing appliances as a means to both capture refrigerants and recycle the appliances, which often have scrap metal value.
- **All refrigerants versus ozone-depleting substances.** Many programs were developed in response to the Montreal Protocol and subsequent Kigali Amendment. As a result, they focus on CFCs, HCFCs, and HFCs. However, the world of refrigerants is constantly evolving. Some programs have elected to focus on the refrigerant gases themselves, while others have expanded into other ODS products such as foams. Some programs are flexible enough to include other refrigerants as they emerge on the market.
- **Refrigerant from residential sources versus all refrigerants.** Some programs focus on encouraging residential consumers to dispose of refrigerants and refrigerant-containing appliances in a proper manner. Others focus on the technicians who service and decommission refrigerant-containing appliances regardless of source, incentivizing them properly manage the refrigerants.
- **Government-run versus industry-run programs.** British Columbia created a mandatory extended producer responsibility (EPR) system, making producers of refrigerant-containing appliances responsible for funding and operating a program. British Columbia's program is industry-run with government oversight. Other programs, such as New York City Department of Sanitation's appliance recycling program, are government-run with some industry funding.
- **Voluntary versus mandatory in nature.** A voluntary end-of-life management program could be created without legislative action. A variety of voluntary programs exist and

have varying levels of participation and success. Mandatory programs typically maximize participation, guarantee a level playing field, provide adequate funding, and ensure equitable access.

- **Government-funded versus industry-funded programs.** End-of-life management programs have a variety of funding mechanisms, from government-funded or industry-funded, to deposit-return fee based.

Washington State local solid waste programs

As discussed earlier, refrigerants may be dangerous waste under Washington State's dangerous waste regulations. Businesses, governments, and other entities subject to the dangerous waste regulations must manage their waste refrigerant in accordance with the regulations.

Residential consumers and exempt small businesses typically have a few options when their refrigerant-containing appliances reach the end-of life:

- They rely on contracted technicians to decommission the appliance, capture the refrigerant, and properly manage or dispose of it (such as in a home air conditioning system). Depending on the type of equipment and the services provided, these technicians may remove the entire appliance from the property.
- When consumers buy a new appliance, like a refrigerator or freezer, the retailer may offer a service to haul the old appliance away, often for an additional fee.
- Equipment owners may also self-haul the appliance to a local solid waste transfer station, landfill, or private recycler. Some locations will accept the appliance for free, others charge a fee.

The services available to equipment owners are frequently dependent on location. Some county programs accept appliances with refrigerants, while others require removal of the refrigerant first. Many charge a fee. After accepting equipment containing refrigerants, the local solid waste facility then must either:

- Have trained staff properly remove refrigerant from the appliance.
- Hire technicians to come and drain the refrigerant from the appliance.
- Send the appliance directly to a recycler.

Although refrigerant is legally required to be captured, multiple stakeholders expressed the belief that illegal venting of refrigerants to the atmosphere does occur. Once drained of refrigerant, many of the appliances end up at a scrap metal recycler. Very few programs address the insulating foam within refrigerators or freezers, which also contain HFCs that can be released into the environment if not removed before the appliances are shredded for recycling. Recyclers following EPA's [Responsible Appliance Disposal \(RAD\) program](https://www.epa.gov/rad/about-rad-program)⁴² remove the foams before recycling and send them for reclamation or destruction.

⁴² <https://www.epa.gov/rad/about-rad-program>.

For local government solid waste programs, dealing with these appliances can be quite costly. There may not be a local outlet to take the refrigerant, and they may have to pay to transport appliances long distances for recycling. Even though the appliances have scrap metal value, it may not be enough to offset the cost of management.

For consumer products such as aerosol cans of refrigerant, most local facilities will accept them for free from residential customers, but most will charge small businesses a fee.

California Air Resources Board Small Refrigerant Container Program

The California Air Resources Board has a regulation governing the management of small cans of refrigerant commonly used to recharge automotive air conditioners.⁴³ The regulation requires retailers to charge a ten-dollar refundable deposit on the sale of small containers of automotive refrigerant, similar to bottle deposit programs.

The program is very narrow in scope as it is limited to small cans of automotive refrigerant. However, broader application of a deposit-return system could be considered as part of an end-of-life refrigerant management program. For example, for technicians who routinely service air conditioning or refrigeration systems and have gas canisters for refrigerant, there could be a refundable deposit on canisters returned full of refrigerant.

More information about this program is available at [CARB Small Containers of Automotive Refrigerant Program](https://ww2.arb.ca.gov/our-work/programs/small-containers-automotive-refrigerant).⁴⁴

New York City Department of Sanitation Appliance Recycling Program

New York City passed a law in 2014 requiring refrigerant-containing appliance manufacturers fund a system to collect refrigerant at the end-of-life of the appliance. The program started in 2015 and has since processed over 350,000 refrigerators, freezers, air conditioners, dehumidifiers, and water coolers in their curbside recycling program. After residents place the appliance at the curb, Department of Sanitation technicians capture the refrigerant in advance of the recycling trucks that pick up the appliance. The technicians log model and serial numbers of the appliances and the city invoices appliance manufacturers a flat rate of fifteen dollars per appliance processed.⁴⁵

⁴³ As of July 25, 2021, cans that contain high-GWP (above 150) and other regulated refrigerants can no longer be sold in Washington State pursuant to RCW 70A.60.080.

⁴⁴ <https://ww2.arb.ca.gov/our-work/programs/small-containers-automotive-refrigerant>.

⁴⁵ The amount was set as part of a settlement from a legal challenge to the city's legal authority to create the program.

In a one-on-one conversation, the city official in charge of the program estimates it cost the city fifty dollars per appliance, so the fifteen-dollar reimbursement from appliance manufacturers does not cover program costs, even when the city sells the appliances to scrap dealers.

More information about this program is available at [DSNY CFC Recovery Program](#).⁴⁶

Major Appliance Recycling Roundtable (British Columbia)

The British Columbia Recycling Regulation, under the Environmental Management Act, was the most comprehensive of the programs Ecology explored. It sets out requirements for extended producer responsibility programs in the province. The Major Appliance Recycling Roundtable (MARR) is a not-for-profit stewardship organization that implements the program for end-of-life major household appliances. The Association of Home Appliance Manufacturers Canada and the Retail Council of Canada jointly developed the program. While the scope of the program includes home appliances beyond those with refrigerants, capturing refrigerants is a key component of the program.

The collection system is comprised of a network of retailers, local governments, utilities, and private companies that accept the appliances and channel them to scrap metal processors. MARR provides financial incentives along the way to encourage proper collection and management of ODS, and to offset the costs of administration and transportation. They set standards, report data, track performance metrics, conduct consumer education, and manage program finances.

Because appliance producers fund the end-of-life management, they have an incentive to “green” appliances, taking steps to improve recyclability and energy efficiency, minimize the use of toxic materials, and switch to lower-GWP refrigerants and foam blowing agents.

More information about this program is available at [Major Appliance Recycling Roundtable](#)⁴⁷ and [British Columbia’s Government Extended Producer Responsibility](#)⁴⁸ page.

Refrigerant Reclaim Australia

In Australia, the Product Stewardship Act of 2011 required that country’s Department of Agriculture, Water and the Environment to develop a priority list of products to be considered for a product stewardship approach.⁴⁹ Refrigeration and air conditioning equipment was considered, but the Department ultimately did not pursue a government-run stewardship program because, “a cost benefit analysis did not show a net benefit to society.”⁵⁰

⁴⁶ <https://www1.nyc.gov/assets/dsny/site/contact/cfc-recovery-appointment-request>.

⁴⁷ <https://www.marrbc.ca/>.

⁴⁸ <https://www2.gov.bc.ca/gov/content/environment/waste-management/recycling/extended-producer-responsibility/recycling-regulation>.

⁴⁹ The Product Stewardship Act of 2011 was later superseded by the Recycling and Waste Reduction Act of 2020.

⁵⁰ <http://www.environment.gov.au/protection/waste/product-stewardship/product-schemes/projects>.

Importers of refrigerants are instead required to commit to a product stewardship approach for any refrigerants contained in imported equipment or containers under Australia's Ozone Protection and Synthetic Greenhouse Gas Management Act of 1989.⁵¹ The Refrigerant Reclaim Australia (RRA) program was created to fulfill this role. Funded by a levy⁵² on the import and sale of new refrigerants and approved by the Australian federal government, RRA is a not-for-profit product stewardship organization for the Australian refrigerants industry. Since 1993, RRA has worked nationally to share responsibility for and costs of recovering, reclaiming, and destroying surplus and unwanted refrigerants.

The primary component of the RRA program is to provide rebates to contractors who recover and return refrigerants to wholesalers through the Gas Seeker Program. RRA encourages contractors to recover, reuse, and recycle refrigerant and return all unwanted refrigerant for safe disposal. According to their website, RRA claims annual refrigerant recovery to be "in the order of 500 tonnes."⁵³ Historically, most collected refrigerants were destroyed, but the amount reclaimed has grown in recent years. RRA works to help all participants across the refrigerant industry, from contractors to wholesalers, comply with Australia's regulations and environmental protocols.

Another key component of RRA's program is the national collection service, which transports collected refrigerants to a central storage facility for reclamation or destruction. RRA also conducts educational and promotional campaigns.

More information about this program is available at [Refrigerant Reclaim Australia](https://refrigerantreclaim.com.au/).⁵⁴

⁵¹ <https://refrigerantreclaim.com.au/our-role/ozone-protection-act/>.

⁵² Australian law defines a levy as "a temporary tax collected by federal, state or local governments and used for a stated public purpose." Taylor, Madeline (2012) "Is it a levy, or is it a tax, or both?," Revenue Law Journal: Vol. 22: Iss. 1, Article 7. Available at: <http://epublications.bond.edu.au/rlj/vol22/iss1/7>. Ecology is not clear whether this is equivalent to a tax under US law.

⁵³ <https://refrigerantreclaim.com.au/program-performance/>.

⁵⁴ <https://refrigerantreclaim.com.au/>.

Stakeholder Input, Feedback, and Suggestions for a Washington State Program

Stakeholder process and participation

Section 14, Chapter 315, Laws of 2021 requires Ecology to “solicit feedback from potentially impacted parties and the public” about the possible elements of an end-of-life refrigerant management program. Ecology received helpful feedback and input from a wide variety of stakeholders through its stakeholder engagement process.

Project web page

Ecology created a dedicated [“EZView” web page](#)⁵⁵ for work related to the end-of-life refrigerant management program project. This page contained general information about the project, contact information for Ecology staff, links to webinar registrations, and copies of relevant documents, including planning documents, the underlying legislation, public comments received, and source materials.

Stakeholder outreach

Ecology sent email invitations to representatives of many potentially affected organizations, prioritizing those that testified on the bill during the 2021 Legislative session. We also made a number of personal phone calls to interested parties and organizations, inviting them to participate. In addition to outreach to specific entities, Ecology also sent an email to all agency HFC Listserv subscribers. We published a notice on the Ecology “Public input & events” web page and established an eComments page to simplify submission of comments.

Participating stakeholders

Ecology obtained input from a variety of potentially impacted parties, including:

- Mechanical Contractors Association of Western Washington.
- Air Conditioning, Heating, and Refrigeration Institute.
- U.A. Local 32 Plumbers Pipe Fitters Refrigeration & HVAC Union and Washington State Association of U.A. Plumbers & Pipefitters.
- Hazardous waste disposal facilities and recyclers.
- County solid waste directors and programs.
- Institute for Governance and Sustainable Development.
- Environment Investigation Agency.
- Refrigeration equipment manufacturers and any related associations.
- Refrigerant manufacturers and any related associations.

⁵⁵ https://www.ezview.wa.gov/site/alias__1962/37700/refrigerants_management_program.aspx.

- Recycling and reclamation services.
- Food and beverage processors/manufacturers/breweries/dairies.
- Environmental advocates.
- Chemical manufacturers.
- Other organizations that testified on E2SHB 1050.

Webinars

Ecology conducted two webinars open to all interested stakeholders and the public. The webinars started with a brief project overview presentation from Ecology and then devoted the majority of the webinar to obtaining attendee feedback. Comments were summarized in real time in the presentation so attendees could see their comments being recorded and could correct any mistakes or misunderstandings. Ecology posted copies of the webinar materials, including the comments received, on the project’s EZView web page. The two webinars had a combined 55 unique attendees (70 total attendees).

Written comments from stakeholders

Ecology received written comments from six organizations.

A number of organizations also asked for and received one-on-one conversations with Ecology staff. Ecology spoke with representatives from:

- Chemours (refrigerant manufacturer).
- Total Reclaim (refrigerant reclaimer).
- Washington Air Conditioning Contractors Association.
- Washington Food Industry Association.
- ARCA Recycling, Inc. (appliance recycler).
- Mechanical Contractors Association of Western Washington.
- Washington State Association of the United Association of UA Pipetrades.
- Air Conditioning, Heating, and Refrigeration Institute.

Issues raised and stakeholder contributions

Stakeholders provided feedback on a number of issues related to refrigerant management, including some that were not specific to end-of-life issues. Ecology believes each of these suggestions warrants additional research and stakeholder work as part of developing the “optimal design” for a management program.

The most common issues we received input on include:

Extended Producer Responsibility

Participating stakeholders generally expressed support for an EPR approach to end-of-life refrigerant management, placing primary responsibility for funding and operating a program on producers of refrigerants and/or refrigerant-containing equipment and appliances. Washington has existing EPR programs for a number of other waste streams, including electronics, paint, mercury-containing light bulbs, and others.

It is important to note that we did not receive any written comments from product manufacturers, although we did have conversations with a main refrigerant manufacturer. Had these stakeholders provided more input, they may have supported a different approach. Other key stakeholders who may be affected by an EPR approach and who did not submit written comments include local government solid waste programs, tribal governments, solid waste haulers and recyclers, and scrap metal yards.

Broad program applicability

Stakeholders expressed a variety of opinions regarding program scope and applicability. The most common message expressed by stakeholders was that an end-of-life refrigerant management program should have broad applicability, covering participants throughout the entire life cycle of refrigerants and equipment. Two stakeholders specifically recommended focusing primarily on mid- and larger-sized equipment, such as supermarket refrigeration systems and residential and light commercial air conditioning systems.

Ease of use

All stakeholders appeared to support ensuring that an end-of-life refrigerant management program was easy to use. Specific suggestions included scaling up existing utility-based programs to facilitate appliance recycling, partnering with retailers to have old appliances delivered directly to recyclers, ensuring service technicians have convenient and free options for disposing of used refrigerants, and establishing convenience standards to ensure that the program is accessible statewide.

Program flexibility

Stakeholders cautioned Ecology about ensuring that an end-of-life refrigerant management program is sufficiently flexible to accommodate future market changes and some suggested that incorporating incentives into the program might be a way to do so. Currently, there is no outside incentive for technicians to properly reclaim and recycle HFC refrigerants (other than laws requiring them to do so). As manufacturers are still producing these substances, there is no scarcity to create a market value. An end-of-life program must be flexible enough to establish or discontinue program elements as necessary and as market forces change,

especially as manufacturers introduce new refrigerants. One stakeholder expressed the sentiment, “Don’t carve reclaim policies in stone initially.”⁵⁶

Incentives

In addition to being mentioned in the original legislation, a variety of stakeholders made suggestions about how to incorporate incentives into a management program. This was commonly part of discussions or suggestions related to an extended producer responsibility approach, as mentioned above. Stakeholders specifically mentioned incentives or rebates as a possibility to encourage equipment owners to swap out older systems for newer ones that use more environmentally friendly refrigerants. Other incentives ideas included free disposal of refrigerant-containing appliances for residents, free access to trained technicians to capture refrigerant from appliances at solid waste facilities, and monetary incentives for technicians to turn-in captured refrigerant to reclaimers.

Carbon and greenhouse gas credits

Some stakeholders raised an issue of a possible connection between reclaimed refrigerants and carbon or greenhouse gas credits, whether for individual businesses or utilities. Although stakeholders did not express a strong recommendation that this should be a program element, they seemed supportive of investigating this idea in the future.

Licensing systems

Stakeholders made two different recommendations regarding licensing. First, some stakeholders strongly recommended the adoption of an HVAC licensing system, similar to those for electricians and plumbers. They expressed concerns about a level playing field and the potential for out-of-state contractors to come into Washington and “do shoddy work” with little regard for refrigerant releases to the environment.

Second, one additional stakeholder recommended that wholesalers and distributors of bulk HCFCs and HFCs also be licensed by the state. This could help ensure these chemicals are only sold to those with proper training in the handling of refrigerants.

Mandatory requirements

Stakeholders made a number of suggestions for mandatory elements in an end-of-life management program, including:

- Retailer participation in EPA’s Responsible Appliance Disposal program.
- New equipment must use recycled HFCs.
- Use of reclaimed refrigerants.
- Use of refrigerants acceptable under EPA’s Significant New Alternatives Policy program.

⁵⁶ Air Condition, Heating, and Refrigeration Institute July 21, 2021 public comment letter. https://www.ezview.wa.gov/Portals/_1962/Documents/refrigerants/AHRI%20Comments%20-%20Washington%20State%20Reclaimed%20Refrigerant%2020210721.pdf.

- State policies or other requirements that mandate the use of reclaimed refrigerant in state-owned and operated buildings.
- Incorporate federal refrigerant management policies similar to those adopted by California.
- Distributors must take back recovery cylinders at no cost to technicians.
- Distributors and wholesalers must take back used refrigerant.
- Required reporting by technicians.

Education, outreach, and enforcement

Stakeholders generally supported increasing education and outreach efforts for both regulated businesses and the public. Webinar participants expressed concern that homeowners may not know what is legal and not. They expressed special concern that homeowners likely do not know it is illegal to vent refrigerants to the atmosphere. Other stakeholders suggested that Ecology expand existing technical assistance programs to provide assistance to small businesses regarding refrigerants.

Five of the six written comment letters addressed the need for increased enforcement, but none gave specifics as to how Ecology should reprioritize existing priorities or how additional enforcement actions should happen. One letter noted that lack of enforcement actually harms law-abiding technicians the most, providing a perverse incentive to illegally vent refrigerants. Some webinar stakeholders also referenced the importance of increased enforcement, noting enforcement related to illegal venting of refrigerants is “really important” but essentially does not currently exist. No stakeholders expressed an opinion disagreeing with a reprioritization of current enforcement efforts.

Funding

Finally, funding was an important issue raised in five of six written comment letters submitted to Ecology as well as a topic of discussion during both stakeholder webinars. There was a clear lack of consensus among stakeholders regarding possible funding approaches. Some suggestions included:

- Deposits paid by producers.
- Penalties for retailers and online vendors selling illegal products and penalties to “incentivize compliance.”
- Levy on imports and sales of virgin ODS and HFC refrigerant and/or pre-charged equipment.
- Mandatory fee on all virgin ODS and HFC refrigerant sold.
- Funding from revenues generated by the “Western Climate Initiative” (we assume this commenter was referring to the new cap-and-invest program required by law).
- State funding.

- Producer funding through a stewardship organization.
- Fee generated revenue.

Some of the stakeholder comments also suggested setting fees based on the GWP of the refrigerant, a practice known as eco-modulation.

Ecology's Recommendations for a Washington State End-of-life Refrigerant Management Program

While it is possible to design an end-of-life management program with the information currently available, Ecology does not believe this information is sufficient to provide final recommendations regarding the “optimal design” for such a program. Ecology’s research and its stakeholder process revealed important new information that should be incorporated into the program design and parameters. While there was general agreement on broad policy statements, the stakeholder engagement process did not achieve consensus among stakeholders on program specifics.

Below are recommendations for possible actions and next steps in developing and implementing an end-of-life refrigerant management program for Washington.

Ecology actions

Based on stakeholder input and feedback, Ecology identified some actions that do not require legislative action. Ecology already has authority to make these suggested changes, and is taking steps to investigate or implement these measures.

Amend WAC 173-303-506 to include HFCs

As noted above, Ecology is the designated “authorized program” for EPA and the federal hazardous waste laws in Washington. This means Washington’s dangerous waste regulations—Chapter 173-303 WAC—are the vehicle for implementing RCRA hazardous waste regulations. Washington may adopt additional or more stringent requirements than the federal rules, but no state regulation may be less stringent than its federal counterpart.

As a parallel regulation matching EPA, Ecology adopted the solid waste exclusion for recycled CFCs and HCFCs into the Washington dangerous waste regulations at [WAC 173-303-506](#).⁵⁷

Numerous stakeholders expressed support for treating reclaimed HFCs in the same manner as reclaimed CFCs and HCFCs, expressing the same concerns EPA expressed in 1991. Ecology agreed with this suggestion and has already started the process to include this change in the next update of Washington’s dangerous waste regulations. We are also investigating the possibility of adding HFOs to the solid waste exclusion.

Expand Ecology outreach to businesses generating and reclaiming end-of-life refrigerants

To date, Ecology’s interactions with businesses handling refrigerants has focused primarily on those businesses involved with refrigerant reclamation. As tracking and reporting requirements for service technicians are federal requirements, Ecology has deferred work in this area to EPA.

⁵⁷ <https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-506>.

Stakeholders generally supported Ecology taking steps to increase outreach efforts to regulated businesses handling refrigerants as well as owners of equipment and systems regulated under the CAA. Ecology is investigating and considering a number of possible approaches for increasing technical assistance and educational materials for these businesses.

Potentially reprioritize Ecology oversight and enforcement of existing regulations

The federal and state Clean Air Acts as well as RCRA and the Washington dangerous waste regulations each prohibit the intentional venting of refrigerants to the air instead of recovering them in a proper manner. However, Ecology has recognized that catching someone in the act of illegally venting refrigerant is highly unlikely. As a result, Ecology has not prioritized inspections and enforcement actions for these violations.

Ecology may also develop outreach materials to educate equipment owners, service technicians, and reclamation businesses about the applicable legal requirements and how they can comply. As part of its routine work moving forward, Ecology may also incorporate an additional inspection focus for regulated businesses to help ensure they are complying with the regulations regarding proper handling, recycling, and disposal of refrigerants.

Recommended elements for end-of-life refrigerant management program

Additional work remains to further refine end-of-life management program elements

While many stakeholders participated in the webinars, not all affected industry sectors were adequately represented in Ecology's stakeholder process to date. Ecology asked stakeholders for broad input, rather than comment on any particular proposal. As elements of an end-of-life management program are developed, it will be important to provide all stakeholders with time to comment, and continue to provide feedback in order to achieve a wide level of support for the program. Among the key stakeholder groups still to contribute are retailers, local government solid waste programs, tribal governments, commercial building owners, and the scrap metal industry.

Any future stakeholder engagement should address the following specific questions and issues:

- Whether the program should be run by Ecology, run by an entity under contract with Ecology, run by an independent organization with oversight by Ecology, or whether some other approach is preferable.
- Whether there should be take-back obligations for appliance sellers, including specific proposals.
- Possible funding structures of various program models, program cost estimates, and whether a cost-benefit analysis is needed before deciding the scope of the program.
- Desirability of deposit/return programs (like a bottle bill) for appliance or refrigerant purchasers, including related advantages and disadvantages.

- Whether changes are needed to existing recycling infrastructure to facilitate distribution and return of refrigerant from technicians, including potential collection locations for appliance returns.
- Developing more detail about the operation of current retail take-back programs and how each participating retailer works.
- Identifying barriers to proper refrigerant management and strategies to address them.
- Geographic analysis of the collection of refrigerant-containing appliances from solid waste facilities, including the flow of material to recyclers and scrap yards.
- Estimation of the current volume of refrigerants in Washington and the estimated amounts that will be reclaimed, recycled, or ultimately destroyed.
- Desirability of developing a state licensing program for HVAC contractors and technicians.
- Potential for carbon credit generation for refrigerant destruction.
- Developing more information about technologies and processes to capture ODS in foam.
- How to integrate end-of-life refrigerant and refrigerant-containing equipment management into the larger refrigerant management program established under Section 9 of [E2SHB 1050](#).⁵⁸

Although these overarching program components had good support among stakeholders, we believe additional work remains to further refine the issues through additional stakeholder work. When new resources become available in the future, this additional stakeholder work could develop specific program elements based on these general guidelines and would help resolve uncertainties and discrepancies between various stakeholder positions. Ecology does not currently have resources to accomplish this work. Ecology's current resources are fully dedicated to implementing other aspects of Engrossed Second Substitute House Bill 1050.

Address refrigerants as well as refrigerant-containing equipment and appliances

We note that while Ecology's directive was to address end-of-life refrigerant management, the refrigerants themselves are only part of the issue. As noted above, addressing the equipment that contains and uses refrigerants is equally important. As such, we believe both elements must be addressed simultaneously for any program to be successful. A program that addresses the equipment also has the potential to influence other environmental outcomes such as improved energy efficiency, durability, recyclability, and switching to lower-GWP refrigerants.

⁵⁸ <http://lawfilesexternal.wa.gov/biennium/2021-22/Pdf/Bills/Session%20Laws/House/1050-S2.SL.pdf>.

Require management of end-of-life refrigerants according to the state's existing waste management hierarchy

As a whole, stakeholders supported the reclamation and recycling of older refrigerants and one submitted written comment on the issue, recommending prioritization of reclamation over destruction. This approach would be consistent with existing Washington law prioritizing waste reduction and recycling over incineration or other disposal.

Designate an entity for on-going coordination and supervision

An end-of-life management system will require on-going support, management, and supervision. Ecology received input from various stakeholders about this topic, each with a different suggestion. A program could have on-going coordination provided by Ecology through the dedicated staff coordinator, an entity under contract with Ecology with oversight by Ecology, an independent organization with oversight by Ecology (similar to the E-Cycle Washington program), or some other approach. Making this determination and getting buy-in from stakeholders will be a significant undertaking.

Ensure convenient access

An end-of-life refrigerant management program must ensure convenient access to residents, businesses, and technicians. It should include a well-developed network of collection sites and transportation services to ensure captured refrigerants, appliances, and equipment get to an appropriate final destination while complying with applicable dangerous waste and transportation requirements.

Include provisions for all types of refrigerants, not just HFCs

In spite of the restrictions on the production and sale of CFCs and HCFCs, there is still equipment in use that contains these chemicals. One stakeholder informed Ecology that even though production and importation of so-called "virgin" halon chemicals were phased out by law in 1994, there are still halon fire suppression systems in use today and that the halon inside those systems has an indefinite expected useful life when properly recovered and recycled. Those systems persist due to good leak detection and prevention efforts, and when necessary, recovery and reclamation of old halon chemicals. Because these and other legacy systems will potentially continue to exist for an indefinite period, an end-of-life refrigerant management system must be able to accommodate all types of refrigerants, not just HFCs.

This approach is also the most practical, as technicians dealing with end-of-life refrigerants may deal with multiple different types of refrigerant in any given work day. A single approach covering all waste refrigerants will be the easiest for participants to deal with.

Ensure program elements work for tribal and local governments and rural communities

As noted above, end-of-life refrigerators, freezers, and window air conditioning units ultimately become the responsibility of city, county, and tribal governments, either through normal solid waste responsibilities or because of illegal dumping. This is especially true for rural communities and Tribes, as they may have extra challenges related to lack of local suppliers and

service providers. The needs of these entities are crucial to the success of any end-of-life management program. A final program will not be successful if the design does not adequately address issues from tribal and local governments, specifically including the revenue that some local governments generate from scrap metal recycling of old appliances.

Ensure program elements work with the unique needs of multiple participants

Stakeholder feedback clearly illustrated that different participants in the system have vastly different needs and expectations. A successful program must be able to account for each of these different roles and requirements. A resulting end-of-life refrigerant management program should build on existing systems and relationships, not supplant them. A successful program will require shared responsibility between all participants in the system. Our preliminary work identified the following unique groups and needs, although additional stakeholder work may reveal additional concerns:

- **Appliance owners with end-of-life equipment containing refrigerants.** This interest group needs the ability to dispose of old refrigerators, freezers, air conditioners, and other covered appliances easily and at little to no cost. This may be particularly challenging for Washingtonians who live in remote parts of the state and those who lack transportation, especially the ability to transport large refrigerators and freezers.
- **Businesses and other organizations with end-of-life appliances containing refrigerants, including commercial air conditioning units and chillers for food and beverage products.** Like homeowners, businesses also need the ability to dispose of end-of-life equipment, easily and preferably at little to no cost. However, because this equipment contains end-of-life refrigerants, any business disposing of or recycling equipment must comply with the dangerous waste regulations. An end-of-life refrigerant management program might need special provisions to address this potential complication.
- **HVAC industry workers and businesses.** HVAC service technicians and the businesses that employ them must have an easy and convenient way to dispose of end-of-life refrigerants. An end-of-life refrigerant management program may need to give special attention to contractors working in more remote areas of the state where refrigerant distributors may not be conveniently located.
- **Refrigerant recyclers and reclaimers and refrigerant distributors.** There appears to be some overlap between those who recycle end-of-life refrigerants and those who sell and distribute new refrigerants to service technicians. These businesses have crucial knowledge about costs, options, and industry practices and their participation will be key to designing a successful program. It is important to note that a number of these businesses provided feedback for the preparation of this report, but they disagreed on a number of points. It will be important to include broad participation from the various perspectives in this market niche.
- **Equipment and refrigerant manufacturers.** It is possible that extended producer responsibility could be part of the optimal design for an end-of-life management

program. Even if another form of program is selected, extended producer responsibility is likely to be an element of the final management program. It will be important to include manufacturers in program development to ensure the program is practical and implementable. It will also be important to get input from these stakeholders on possible funding options.

- **Automotive professionals and automotive supply retailers.** Like other air conditioning systems, automotive air conditioning systems also use refrigerants. Older vehicles may have systems containing a CFC, while most newer, pre-2021 models use an HFC refrigerant.⁵⁹ As such, repair technicians handle end-of-life refrigerants and need disposal options like HVAC technicians. Sale and use of “AC recharging” products by auto parts and other retailers also need to be addressed in a final program.
- **RCRA-permitted treatment, storage, and disposal (TSD) facilities.** RCRA-permitted TSDs are the proper destination for any end-of-life refrigerants that will be destroyed instead of reclaimed and recycled. These companies will have special insight and practical knowledge about proper handling of end-of-life refrigerants as well as legal requirements under federal and state waste and transportation regulations.
- **Waste haulers.** For many appliance owners, hauling away a failed refrigerator or freezer is an overwhelming task. Many residents do not possess the ability to transport the appliance to a transfer station, and fees associated with disposal may unintentionally encourage illegal dumping of broken appliances. Ensuring that a program works with waste haulers’ Tariff agreements⁶⁰ will be important to a final program design.
- **Scrap recyclers.** Many refrigerant-containing appliances and equipment eventually end up at scrap metal recyclers. These businesses may need incentives to ensure proper removal of refrigerants before shredding occurs. They may also have insight into technologies to address foam insulation within these appliances that contain HFCs.

Address potential mandatory participation for manufacturers of refrigerants as well as manufacturers of equipment using refrigerants

For any end-of-life refrigerant management program to be successful, it must account for the entire refrigerant life cycle.

As most products are manufactured outside Washington State, it will also be important to have a broad definition of who is a “manufacturer” for purposes of the program. Ecology has successfully addressed this issue under a number of laws, including the Children’s Safe Products Act, [Chapter 70A.430 RCW](#). [RCW 70A.430.010](#) defines “manufacturer” as:

(11) “Manufacturer” includes any person, firm, association, partnership, corporation, governmental entity, organization, or joint venture that produces residential upholstered

⁵⁹ <https://www.hansonkia.com/service/information/things-to-know-about-automotive-refrigerant-olympia-wa.htm>.

⁶⁰ The Washington State Utilities and Transportation Commission regulates Solid Waste Company Tariffs, which detail the services companies may provide and the fees they may charge.

furniture as defined in RCW 70A.405.010 or children's product or an importer or domestic distributor of residential upholstered furniture as defined in RCW 70A.405.010 or children's product. For the purposes of this subsection, "importer" means the owner of the residential upholstered furniture as defined in RCW 70A.405.010 or children's product.

Washington's Electronic Recycling Program, commonly known as the E-Cycle Program, also broadly defines "manufacturer" in [RCW 70A.500.020](#).⁶¹

(14) "Manufacturer" means any person, in business or no longer in business but having a successor in interest, who, irrespective of the selling technique used, including by means of distance or remote sale:

(a) Manufactures or has manufactured a covered electronic product under its own brand names for sale in or into this state;

(b) Assembles or has assembled a covered electronic product that uses parts manufactured by others for sale in or into this state under the assembler's brand names;

(c) Resells or has resold in or into this state under its own brand names a covered electronic product produced by other suppliers, including retail establishments that sell covered electronic products under their own brand names;

(d) Manufactures or manufactured a cobranded product for sale in or into this state that carries the name of both the manufacturer and a retailer;

(e) Imports or has imported a covered electronic product into the United States that is sold in or into this state. However, if the imported covered electronic product is manufactured by any person with a presence in the United States meeting the criteria of manufacturer under (a) through (d) of this subsection, that person is the manufacturer. For purposes of this subsection, "presence" means any person that performs activities conducted under the standards established for interstate commerce under the commerce clause of the United States Constitution;

(f) Sells at retail a covered electronic product acquired from an importer that is the manufacturer as described in (e) of this subsection, and elects to register in lieu of the importer as the manufacturer for those products; or

(g) Beginning in program year 2016, elects to assume the responsibility and register in lieu of a manufacturer as defined under this section. In the event the entity who assumes responsibility fails to comply, the manufacturer as defined under (a) through (f) of this subsection remains fully responsible.

Stakeholder engagement may provide insight on how to craft a workable definition similar to one of the above for a future program.

Mandatory participation could help motivate innovation on the part of both equipment and refrigerant manufacturers. It could also help ensure that businesses creating and using the problematic chemicals are directly involved in administration and potentially even funding the program.

⁶¹ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.500.020>.

Address potential mandatory participation for service technicians, refrigerant sellers and distributors, and regulated equipment owners

Businesses generating or otherwise responsible for end-of-life refrigerants are currently subject to Washington's dangerous waste regulations. A refrigerant management program could provide a simplified way for these businesses to comply with the applicable requirements. We heard from HVAC industry stakeholders that this portion of the refrigerant market is the main source of illegal emissions, so making participation mandatory could also help Ecology identify violations of dangerous waste and clean air regulations.

Encourage participation by owners of household appliances and other non-regulated equipment

While many owners are willing to pay a fee to have a waste appliance hauled away for proper recycling, illegal dumping of appliances continues to be a problem. In 2019, an estimated 150 tons of trash, including waste appliances, was dumped on Joint Base Lewis-McChord alone, resulting in annual costs of almost \$500,000.⁶² While not all of those costs are attributable to waste appliances containing refrigerants, they are a notable component of the waste stream.

To be successful, an end-of-life refrigerant management program needs a significant public outreach element to educate appliance owners about the dangers of refrigerants and how to dispose of their waste appliances properly. Survey and focus group work with the public could provide key information about how to encourage and incentivize residents to participate in a final program.

Work with stakeholders to investigate possibility of replacement incentives or rebates

Ecology has recently had success encouraging dry cleaning businesses to switch to less toxic cleaning methods by offering rebates to help offset the cost of new equipment. An end-of-life refrigerant management program could offer something similar for replacing CFC, HCFC, and HFC-containing equipment for those using safer alternatives. Reaching out to utilities that often run appliance replacement rebate programs could be insightful. Significant work would be needed to determine whether this would be a cost-effective strategy.

Incorporate and publicize best practices as part of an outreach and education effort

From manufacture to final destruction of refrigerants and refrigeration equipment, each step in the process has associated best practices. An education and outreach component is vital to an end-of-life management program. This includes best practices for service technicians, reclaimers, and equipment owners.

In an ideal program, each level of service provider would be responsible for providing education and outreach to their end users.

⁶² <https://www.q13fox.com/news/trash-cop-tracks-down-illegal-dumping-on-jblm>.

- **Refrigerant manufacturers:** information about their products, best practices for use and recycling, and general information about the need to properly handle and recover their products.
- **Equipment manufacturers:** information about the refrigerants used in their product; best practices for use, repair, and recycling; and general information about how to ensure refrigerants are not released from the equipment.
- **HVAC and other repair service providers, contractors, and repair shops:** information about repair and proper maintenance of equipment, applicable regulations for technicians as well as customers, and proper recycling or disposal techniques.
- **HVAC-related unions, auto repair certification programs, trade schools, and other training institutions:** information about best practices, handling techniques for technicians at all levels and in all affected industries, how to avoid improper venting, and how to ensure proper reclamation of refrigerants.
- **Refrigerant reclaimers, resellers, and other distributors:** information about the refrigerant and its nature, applicable regulations, best practices for safe use and handling, and how to ensure proper recycling or disposal.
- **Equipment retailers:** information about repair and proper maintenance of appliances and equipment, proper recycling or disposal techniques, general information about why refrigerants need special handling, and how to get additional information.

Establish fees based at least in part on the refrigerant's global warming potential

Ecology did not have sufficient time to get stakeholders to agree on a funding approach. Not surprisingly, each stakeholder group had conflicting ideas about who should pay for an end-of-life management program. Suggestions included the state, refrigerant manufacturers, equipment manufacturers, and end users. A successful program will likely need funding from more than one source, at least initially.

While Ecology does not yet have a final recommendation on a funding plan, we do recommend that fees be based at least in part on the global warming potential of the refrigerant in question. Higher fees for high-GWP refrigerants will encourage manufacturers to design products for lower-GWP refrigerants.

Establish performance goals focused on reducing releases of refrigerants

Depending on the final program scope, performance measures for an end-of-life refrigerant management program might include:

- Percent of estimated emissions reduced.
- Estimated proportion of refrigerants used by type.
- Pounds of refrigerant reclaimed, recycled, and destroyed by type.

- Number of refrigerated appliances properly recycled.
- Number of refrigerated appliances illegally dumped.
- Number of HVAC technicians receiving initial or refresher training.

As the structure of a final program becomes clearer and Ecology is able to conduct more research, additional or different performance measures and goals may be appropriate.

Considerations indirectly related to an end-of-life refrigerant management program

Stakeholders expressed support for a number of actions that, while not strictly related to end-of-life management of refrigerants, would have an effect on the proper recovery, reclamation, recycling, and disposal of refrigerants. While beyond the scope of the Legislature’s assignment, we include them for transparency.

Licensing

As noted above, some stakeholders strongly recommended the adoption of an HVAC licensing system, similar to those for electricians and plumbers. They expressed concerns about a level playing field and the potential for out-of-state contractors to come into Washington and “do shoddy work” with little regard for refrigerant releases to the environment. They recommended a license similar to the [city of Seattle’s existing HVAC license](#),⁶³ arguing that a statewide license administered by Department of Labor and Industries could help ensure proper training for technicians, proper reporting of refrigerant use and recycling, and that refrigerant sellers and resellers only allow purchases by those who have the skill and training to handle these chemicals in a proper manner.

In addition, one stakeholder also recommended that the state issue licenses to wholesalers and distributors of bulk HCFCs and HFCs to help ensure these chemicals are only sold to those who are trained in proper handling of refrigerants.

Education

Even without a new licensing system, some HVAC industry stakeholders recommended additional training for technicians, arguing that additional or yearly refresher training could result in fewer inadvertent or purposeful releases of refrigerants and a better understanding of recovery and reclamation practices.

Destruction credits

Stakeholders raised the possibility of incorporating refrigerant destruction into the larger cap-and-invest program under the [Climate Commitment Act, E2SSB 5126 \(2021\)](#).⁶⁴

⁶³ <http://www.seattle.gov/sdci/codes/licensing-and-registration/refrigeration-licensing>.

⁶⁴ <https://app.leg.wa.gov/billsummary?BillNumber=5126&Year=2021&Initiative=false>.

Conclusion

Although stakeholders were helpful and eager to provide input, Ecology has determined that a more extensive stakeholder process is needed in order to develop recommendations for an “optimal design” of an end-of-life refrigerant management program. The lack of consensus among stakeholders regarding key program elements—such as funding and covered participants—combined with the need for additional research lead Ecology to conclude significantly more work is required.

Based on stakeholder input, Ecology has already begun addressing some actions that do not require legislation or a final program design, including rulemaking to treat HFCs the same as CFCs and HCFCs under the state’s dangerous waste regulations when they are recycled. Ecology is also examining additional outreach and oversight of regulated businesses generating and reclaiming end-of-life refrigerants.

Based on current stakeholder engagement and research, Ecology recommends an end-of-life refrigerant management program broadly should:

- Address refrigerants as well as refrigerant-containing equipment and appliances (such as obsolete or nonfunctioning refrigerators or air conditioners).
- Require management of used refrigerants according to a waste management hierarchy prioritizing reuse, then recycle/reclamation, with destruction as a least-favored option, in accordance with existing state law.
- Have a designated entity for on-going coordination and supervision of the program.
- Include provisions for all types of refrigerants, not just HFCs.
- Address unique needs and issues for tribal and local governments, especially as it relates to end-of-life appliances.
- Address the needs of multiple participants, from manufacturers to end users.
- Require mandatory participation for manufacturers of refrigerants, manufacturers of equipment using refrigerants, service technicians, refrigerant sellers and distributors, and regulated equipment owners.
- Encourage homeowners and other non-regulated equipment owners to participate and make it easy for them to do so.
- Work with stakeholders to investigate the possibility of incentives or rebates for replacement equipment.
- Incorporate and publicize best practices as part of an outreach and education effort.
- Have fees based at least in part on the refrigerant’s global warming potential.
- Have performance goals focused on reducing releases of refrigerants.

Although overarching program components had good support among stakeholders, we believe additional work remains to further refine these issues with stakeholders. Given stakeholder

input and feedback to date, Ecology believes this additional work has a high likelihood of resulting in a program that will not only help reduce emissions from end-of-life refrigerants but will also make it easier to properly recycle these substances and the equipment that uses them.

When resources are available, additional stakeholder work could develop specific program elements based on these general guidelines and would help resolve uncertainties and discrepancies between various stakeholder positions. Ecology's current resources are fully dedicated to implementing other aspects of Engrossed Second Substitute House Bill 1050.

Appendix A. Acronyms

Acronym	Meaning
AHRI	Air Conditioning, Heating, and Refrigeration Institute
AIM	American Innovation and Manufacturing Act
CAA	Federal Clean Air Act
CFC	chlorofluorocarbon
CO₂e	carbon dioxide equivalent
EPA	US Environmental Protection Agency
EPR	extended producer responsibility
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
HFO	hydrofluoroolefin
HOC	halogenated organic compounds
MARR	Major Appliance Recycling Roundtable
ODS	ozone-depleting substances
RAD	Responsible Appliance Disposal program
RCRA	Resource Conservation and Recovery Act
RRA	Refrigerant Reclaim Australia
SNAP	Significant New Alternatives Policy program
TSD	treatment, storage, and disposal facilities
Washington CAA	Washington Clean Air Act