Kimberly Goetz
Department of Ecology
Olympia, WA 98504-7600

RE: Washington State HFC end-of-life management

Dear Ms. Goetz:

The Natural Resources Defense Council (NRDC) appreciates the opportunity to provide comment to the Washington State Department of Ecology (Ecology) regarding managing hydrofluorocarbon (HFC) refrigerants at equipment end of life (EOL). This comment responds to the directive in HB 1050, Reducing Greenhouse Gas Emissions from Fluorinated Gases, for Ecology to provide recommendations to the Legislature regarding the design of a program to address the EOL management and disposal of refrigerants.

NRDC has long championed transitions away from fluorinated gases (F-gas) that damage earth's stratospheric ozone layer and climate. Hydrofluorocarbons (HFCs), the current generation of these gases, are climate super-pollutants thousands of times more damaging than carbon dioxide (CO_2). Ozone-depleting substances (ODS) such as chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) continue to pose serious but attenuating threats to the atmosphere. A well-designed refrigerant management program will control and contain refrigerant gas from cradle to grave to ensure that these gases never reach the atmosphere.

Designing and implementing a robust management program for refrigerants at EOL is especially relevant as extreme heat grips the Pacific Northwest, demand for cooling in Washington rises, and the Environmental Protection Agency's (EPA) HFC allocation and phasedown rule comes into force. EPA's allocation rule is the first step in implementing the American Innovation and Manufacturing (AIM) Act, the law that requires an economy-wide phasedown of HFC supply by 85 percent over the next 15 years. Among other things, the AIM Act requires EPA to promulgate rules on the servicing, repair, installation and disposal of equipment.[1] Washington's refrigerant management program can serve as a model for a future EPA program and complement the efforts of the federal government to avoid unnecessary HFC emissions.

NRDC looks forward to continuing a productive collaboration with Ecology, other environmental organizations, and members of industry during the implementation of HB 1050 and the national HFC phasedown.

Successful refrigerant management requires the addressing the already installed bank of refrigerants. Leak prevention, servicing practices, refrigerant recovery, and reuse or destruction of refrigerant are all important links in the chain of the refrigerant lifecycle. The challenges and opportunities to avoid refrigerant emissions vary based on the application. Since F-gases are used in an array of applications, each approach to mitigate refrigerant emissions must be tailored to the specific requirements of the application. Cooling applications can be broadly categorized into two groups: commercial and industrial refrigeration and air-conditioning, and residential cooling appliances, such as window air-conditioners,

[1] Subsection (h)(1) of the AIM Act. "[..] the Administrator shall promulgate regulations to control, where appropriate, any practice, process, or activity regarding the servicing, repair, disposal, or installation of equipment (including requiring, where appropriate, that any such servicing, repair, disposal, or installation be performed by a trained technician meeting minimum standards [..]"

refrigerators, and freezers. Commercial equipment is usually overseen by professional operators, is regularly serviced, and is subject to reporting and recordkeeping requirements. Therefore, promoting better practices for leak prevention, servicing, and recovery at EOL is more manageable because these systems are professionally managed and operated.

Keeping track of and promoting better practices for residential appliances is more challenging. Consumer accountability is harder to achieve and residential equipment is often inadequately maintained and inappropriately disposed of. We encourage Ecology to create a comprehensive strategy to avoid refrigerant emissions from both commercial and residential equipment. The strategy must address emissions at all the different stages of the refrigerant's lifecycle, including but not limited to EOL. When equipment has reached its EOL, the refrigerant contained in the cooling circuit must be recovered. As discussed later on, venting of refrigerant is prohibited under federal law. But that's not the end of it – what happens to that recovered refrigerant is equally important. It is critical to promote refrigerant reclamation (and in some specific cases destruction) over refrigerant venting or landfilling of F-gas-containing cylinders.

The complicated nature of refrigerant management is in part due to the large number of entities involved in the refrigerant's lifecycle: manufacturers, consumers, equipment operators, service technicians, distributors, equipment recyclers, and reclaimers. The success of a holistic refrigerant management program depends on the coordinated engagement of all of these stakeholders.

Efforts must be made to always recover refrigerant from all appliances and commercial equipment. Once recovered, the refrigerant can be landfilled, stockpiled, recycled, reclaimed, or destroyed. Of those options, reclamation is where the most environmental value lies. Reclaimed refrigerant reduces reliance on virgin refrigerant which may enable an accelerated economy-wide phasedown of HFCs. EOL management efforts should prioritize recovery and reclamation over other options.

The following comments focus primarily on residential appliances and reclamation of refrigerant, as this appears to be the focus of the report and indeed has been a major gap in federal refrigerant management programs to date. As Ecology considers a broader refrigerant management program in later stages, we encourage the agency to develop a comprehensive approach that deals with lifecycle emissions from both commercial and residential equipment, seeks to maximize refrigerant recovery in the state, and supports reclamation. Washington should continue to focus on ways it can lead, enhance, or complement forthcoming federal regulations in this area under the AIM Act.

1) ***Funding sources for incentive programs related to EOL refrigerant management; Implementation of extended producer responsibility (EPR) or product stewardship for refrigerators in Washington.***

NRDC urges Ecology to consider creating a product stewardship program for *all* heating, ventilation, air conditioning, and refrigeration (HVACR) equipment containing CFC, HCFC, and HFC refrigerants. The scope of this program should go beyond household appliances to cover commercial cooling equipment as well.

A product stewardship program would require that either refrigerant producers or equipment manufacturers assume financial responsibility for the management of ODS and HFC refrigerants from cradle to grave. This framework follows the 'polluter pays' principle, the belief that producers of environmental pollutants should pay for their products' containment and cleanup. Existing networks of service technicians and reclaimers in Washington will be responsible for the physical management of these gases, such as during EOL management.

Product stewardship programs are not new to Washington. Since 2017, Ecology has managed the E-Cycle program, a product stewardship program in which electronics manufacturers assume financial responsibility for the recycling of e-waste. Manufacturers include product stewardship costs in their cost of doing business. Washington residents can recycle their electronic devices for free but pay for the costs of optional services, such as curbside waste pickup. Third-party recycling companies, rather than electronics manufacturers themselves, typically carry out the physical recycling of these devices. These recyclers must follow state standards in their operations. To date, the E-Cycle program has collected over 433 million pounds of electronics statewide.[2]

Since third-party recyclers are responsible for physical recycling, this program better resembles "product stewardship" rather than "extended producer responsibility" (EPR), which would require manufacturers to assume both financial and physical responsibility for product recycling and is the term Ecology uses on their website.[3]

A) Fees to fund a product stewardship for HVACR equipment

A key question is how product stewardship would be implemented for HVACR equipment in Washington. Several countries, such as Australia, Norway, Canada, and the European Union have implemented variations on product stewardship and EPR. Each of these countries applies a levy on imports and sales of virgin ODS and HFC refrigerant and/or pre-charged HVACR equipment.[4] The revenues from these fees finance rebates and incentives for companies, distributors, and facilities that provide EOL refrigerant management services. The United States also imposed an excise tax on CFC refrigerants, which have been phased out under the Montreal Protocol. The downstream market managed to absorb the higher costs of CFC, from both this tax and from CFC scarcity. Australia's excise tax on ODS and HFC refrigerant also did not have an observable impact on the size of the refrigerant market. In both cases, higher prices of these climate-damaging refrigerants may have accelerated the adoption of climate-friendlier alternatives.

In a similar fashion, Washington could apply a mandatory fee to all virgin ODS and HFC refrigerant sold in the state. There are two ways that Ecology could design such a fee. First, fees could vary in size across species of refrigerants, depending on criteria such as the global warming potential (GWP), ozone depletion potential (ODP), or the relative costs of recovering and reclaiming that particular species of refrigerant. This approach may be environmentally ideal but more complex to execute. Second, Ecology could apply a *flat* fee to all virgin ODS and HFC refrigerant sold. This design avoids penalizing entities that happen to use specific types of refrigerant and sectors where climate-friendlier refrigerant alternatives are less available. Ecology can then use these revenues to fund incentives for specific refrigerant management practices at EOL. Since refrigerant costs account for less than one percent of the lifetime cost of residential and commercial equipment, these fees if designed appropriately will not have an adverse effect on consumers' ability to operate HFC-containing equipment.[5]

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[2] Department of Ecology. "Electronics (E-Cycle) - Washington State Department of Ecology." Accessed July 16, 2021. https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Electronics-E-Cycle.

[3] Nicol, Scott and Thompson, Shirley. "Policy Options to Reduce Consumer Waste to Zero: Comparing Product Stewardship and Extended Producer Responsibility for Refrigerator Waste." *Sage Journals*, June 1, 2007. https://journals.sagepub.com/doi/abs/10.1177/0734242X07079152.

[4] EIA Global. "Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem," February 14, 2019. https://eia-global.org/reports/20190214-search-reuse-destroy.

[5] JMS Consulting & INFORUM. "Consumer Cost Impacts of U.S. Ratification of the Kigali Amendment." AHRI, November 2018, 1.

Beyond generating revenue to fund key programs, a fee on virgin HFC increases the effective market value of reclaimed HFC refrigerant. This rise in market value will accelerate growth of the reclaim industry. Applying a fee to pre-charged equipment containing HFCs would also make equipment using ultra-low GWP refrigerants more attractive to consumers.

If Ecology chooses to design a product stewardship program, it should be conscious of raising costs of refrigerant beyond what consumers can reasonably afford. Ecology should consider that phasedown of HFCs will cause the price of virgin HFCs to rise, and additional sources of revenue, such as Washington's cap-and-invest program, could provide supplementary funds down the road.

Ecology can consider a two-pronged product stewardship program that can fill in key gaps in existing utility programs (described in section 2). First, applying a fee at the time of purchase for pre-charged refrigerators and air conditioners instead of a fee incurred at the time of disposal helps remove the incentive for residents to dispose of their equipment irresponsibly. In Japan, for example, lawmakers applied a fee *at the time of purchase* to cover EOL refrigerant management for motor vehicle air conditioners. This fee succeeded in boosting compliance.[6] Second, Ecology can use revenues from the fee to cover equipment pickup and transport to recycling centers, rebates for equipment owners, and costs of refrigerant recovery.

To streamline refrigerator pickup and disposal, Ecology can further partner with retailers to have appliance delivery drivers take away and transport old appliances to recycling facilities upon dropping off a new appliance at a resident's home. This drop-off/pick-up strategy reduces effort for the consumer. Revenues from product stewardship can reimburse retailers for this work.

Further discussion of how revenues from product stewardship fees can be used is below.

B) Revenues from Washington's cap-and-invest program, through the Western Climate Initiative

In addition to product stewardship fees, revenues from the Western Climate Initiative (WCI), which will total a projected $460 million annually starting in 2023, can fund refrigerant-related programs in Washington.[7] Ecology can deploy some of these funds to supplement revenues from product stewardship. California, the largest member of the WCI, has used $1 million in cap-and-trade revenues to establish the F-gas Reduction Incentive Program (FRIP). FRIP is aimed at easing the transition to low-GWP refrigerants in the food retail sector.[8]

2) How to encourage proper recycling and disposal of household equipment that contains refrigerants; Ideas for incentives to encourage homeowners and businesses to safely dispose of unwanted refrigerants and refrigerated equipment.

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https://www.ahrinet.org/App_Content/ahri/files/Resources/Consumer_Cost_Impacts_of_US_Ratification_of_the_Kigali_Amendment.pdf

[6] Navigant. "AHRI Project 8018 Final Report." AHRI, January 2016, 7. https://www.ahrinet.org/App_Content/ahri/files/RESEARCH/Technical%20Results/AHRI_8018_Final_Report.pdf.

[7] Gannett, Craig and Green, Derek. "Washington State Enacts Cap-and-Trade and Clean Fuels Legislation." Davis Wright Tremaine LLP, May 3, 2021. https://www.mondaq.com/unitedstates/oil-gas-electricity/1090372/washington-state-enacts-cap-and-trade-and-clean-fuels-legislation.

[8] North American Sustainable Refrigeration Council. "New CARB Proposal Represents Successful Collaboration with California Retailers." North American Sustainable Refrigeration Council, February 26, 2020. https://nasrc.org/articles1/2020/2/26/new-carb-proposal-represents-successful-collaboration-with-california-retailers.

There are three key barriers to proper recycling and disposal of household HVACR equipment: cost (in money and time) and lack of information about both the atmospheric damage of refrigerant gases and the HVACR disposal options available to residents. Ecology should ensure that disposing of unwanted refrigerant and HVACR equipment is hassle free and zero cost (or financially beneficial) for homeowners and businesses.

A) Current system – consumers paying fees with rife noncompliance

Currently, because Washington manages waste at a local level, owners of household HVACR equipment typically pay a fee at their local waste collection center to dispose of their refrigerator or air conditioner. In Seattle, for example, residents must pay Seattle Public Utilities $38 to haul away and dispose of home refrigerators.[9] Dozens of private companies in Washington offer similar services at comparable costs for the resident. Local waste collection centers or recyclers then scrap the equipment for metal and recover the refrigerant inside.

The fee at the time of appliance disposal is a disincentive to proper EOL refrigerant management. To avoid paying the fee, residents may dispose of HVACR appliances irresponsibly. Irresponsible disposal may take the form of putting equipment on the street or in dumpsters, where scrap metal hunters may gut refrigerators for parts and may vent the refrigerant inside.[10] According to estimates from the California Air Resources Board (CARB), 77 percent of refrigerant in household refrigerators is lost to the atmosphere at EOL. For window air conditioners, the loss rate is 98.5 percent.[11]

Ecology should better equip state residents with the knowledge, incentives, and capacity to dispose of their home cooling appliances responsibly. Currently, finding information about refrigerator disposal in Washington can be confusing and difficult. For example, although residents must pay for refrigerator recycling in Seattle, they are also eligible for a $30 recycling rebate from Seattle City Light, a public utility.[12] Unfortunately, information about how one obtains this rebate is not easily available on Seattle City Light's website, and hyperlinks that are supposed to lead to more information about rebates instead lead to other pages without this information. Poor organization and low information are commonplace on websites about refrigerator recycling. These deficiencies may lead to low resident participation and compliance.

Furthermore, few websites about refrigerator recycling explain *why* residents should recycle refrigerators in the first place: to prevent CFCs, HCFCs, and HFCs from entering the atmosphere and causing climate damage. It is also not immediately obvious to prospective recyclers that venting refrigerant into the atmosphere is illegal under Section 608 of the Clean Air Act.[13] Ecology should make information easily available to residents about why recycling HVACR equipment is both legally required and environmentally critical.

B) Incentives from utilities – opportunities for scale-up

At a limited scale, utilities in Washington offer rebates and incentives for consumers to recycle functional home cooling appliances, such as air conditioners and refrigerators. Similar to Seattle City Light, Puget

[9] Seattle Public Utilities. "Save Yourself a Trip - Utilities" Accessed July 16, 2021. https://www.seattle.gov/utilities/your-services/collection-and-disposal/transfer-stations/save-yourself-a-trip.
[10] Anecdotes from New Yorkers for Cool Refrigerant Management.
[11] From the California Air Resources Board's best guess average leak rate spreadsheet.
[12] Seattle Public Utilities. "Save Yourself a Trip - Utilities" Accessed July 16, 2021. https://www.seattle.gov/utilities/your-services/collection-and-disposal/transfer-stations/save-yourself-a-trip.
[13] 40 CFR Part 82, Subpart F

Sound Energy (PSE), a utility serving 1.1 million customers in Washington, runs a program that will haul away and recycle customers' old home refrigerators for free. PSE once offered $25 rebates on a first-come, first-served basis, but it is unclear whether this offer has expired.[14]

PSE is also a member of the EPA's Responsible Appliance Disposal (RAD) program, a voluntary partnership initiative aimed at reducing EOL emissions from home HVACR appliances. RAD covers only five percent of home cooling appliances at EOL, and PSE is the only active Washington-specific RAD partner. Ecology should consider collaborating with RAD to foster new partnerships with companies in Washington and to scale up existing work at PSE.[15]

Incentives from utilities to dispose of old refrigerators are not unique to Washington. Across the United States, utilities have targeted old, energy-intensive HVACR equipment in households to improve energy efficiency and reduce costs of additional generation capacity. Other programs, such as Pacific Gas and Electric's incentive in California, offer $50, permanent rebates to customers who recycle home refrigerators.[16] The high, permanent incentive is a key feature of the program that Washington utilities should seek to replicate. Ecology should work with the Washington Utilities and Transportation Commission, among other state actors, to ensure that utility recycling rebates are well-advertised and substantial enough to induce good behavior. Ecology should also ensure that air conditioners, in addition to home refrigerators, are included under the incentive program.

C) Gaps in existing utility programs

A feature of utility incentives is that typically only old, *working* refrigerators are eligible for the incentive. Furthermore, only utility customers are eligible for the incentive. These restrictions align with broader utility goals of getting inefficient, energy-intensive refrigerators unplugged from the grid to reduce costs of energy generation. However, these restrictions mean that recycling of nonfunctional refrigerators that contain F-gases are not incentivized in any way under utility-sponsored programs. These refrigerators that are not eligible for utility incentives may also be the most prone to being scrapped for parts and venting refrigerant in the process. Utility incentives alone are not a bulletproof solution to Washington's appliance recycling problem and could be most effective when coupled with a product stewardship program.

3) Ideas for incentives to encourage businesses to reuse or recycle refrigerants in their equipment.

By law, technicians must recover refrigerant from HVACR equipment at its EOL. After recovery, there are three avenues to use the recovered gas. First, technicians can *recycle* the refrigerant, which involves removing moisture and contaminants from the recovered gas using specialized equipment (this is most common for motor-vehicle air conditioning systems). This cleaned, recovered refrigerant can then be recharged into the same equipment or into equipment owned by the same entity. Second, technicians can *destroy* the recovered refrigerant by sending it to a destruction facility. Third, technicians can send recovered refrigerant to a facility where it can be *reclaimed*. Reclamation involves reprocessing and upgrading recovered refrigerant using techniques such as filtering, drying, and fractional distillation. These processes restore the recovered gas to the same purity standards as virgin refrigerant or better. This

[14] NRDC also called PSE's line for refrigerator recycling to learn more but received no response. The uncertain status of this incentive is another example of outdated and confusing information on websites.
[15] EIA Global. "Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem," February 14, 2019, 6. https://eia-global.org/reports/20190214-search-reuse-destroy.
[16] Pacific Gas & Electric. "Recycle, Reduce, and Receive!" PG&E Appliance Recycling Program. Accessed July 16, 2021. https://www.pge.com/nots/kcmail/arp_magnets_102914.html.

reclaimed gas can then be resold on the market. Reclamation is a crucial process as the country phases down HFCs because it reduces demand for the production of virgin refrigerant.

The current market of reclaimed HFC refrigerant in the United States is small. In 2020, approximately 15,000 metric tons of HFC refrigerants were recoverable from retired equipment in the United States, but only 2,700 metric tons of HFC were reported to have been reclaimed.[17] By 2025, over 25,000 metric tons of HFC will be recoverable from retired equipment. Although the EPA prohibits venting HFCs and ozone-depleting substances (ODS) into the atmosphere, EPA has found that enforcement for this rule is administratively challenging.[18] Since these prohibitions are rarely enforced, they alone have not proved effective in boosting refrigerant recovery rates.[19]

The key constraints on the reclaim market are economic factors. Reclaimed refrigerant is attractive to consumers only when the price of supplying virgin refrigerant exceeds the total cost of reclaim (including recovery, transportation, and chemical reprocessing). Virgin HFC is still available on the market at low prices. If the price of virgin HFC refrigerant is low, recovery rates of HFC and subsequent reclaim are likely to remain low as well. Although the price of virgin HFC is expected to rise as the phasedown progresses, it is unclear how fast the price will rise and how soon reclaimed refrigerant will become cost competitive.

A) Mandating the use of reclaimed refrigerant

Ecology should consider establishing a "Reclaimed Refrigerant Standard," a mandate that all HVACR equipment using HFCs be serviced with a certain percentage of reclaimed refrigerant each year. This percentage would rise annually. Ecology could verify that companies comply with this rule by maintaining labeling, reporting, and tracking requirements for reclaimed and virgin refrigerant. On a national level, EPA has proposed labeling and tracking refrigerant cylinders with QR codes. Ecology should seek to minimize labeling and tracking overlap with EPA's future system where possible.

Ecology could also work directly with technicians who service HVACR equipment to ensure that the required percentage of the refrigerant that they use is reclaimed. Ecology could then inspect or audit technicians to ensure that they are abiding by this rule.

This proposed standard has the potential to be effective in several ways. First, mandating use of reclaimed refrigerant would reduce demand for virgin refrigerant and support reclaimers in expanding their operations. The resulting increased value of reclaimed refrigerant will provide a greater incentive for service technicians to recover refrigerant properly – what today is considered waste, will become a valuable commodity. In addition, technicians will depend on a steady and cheap supply of reclaimed refrigerant to do their work, further incentivizing appropriate recovery practices. Second, a standard that has a gradually rising bar for reclaimed refrigerant use may ease industry's transition to reclaimed refrigerant, without shocking reclaimers or technicians.

Some reclaimers can more easily scale up operations than others. Reclaiming some HFC blends, such as R-404A, requires the use of advanced technologies such as fractional distillation. Only larger reclaimers

[17] Starr, Christina and Environmental Investigation Agency. "EIA Comments on Proposed Allocation Rule." Comment submitted by Environmental Investigation Agency (EIA), July 9, 2021. https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0044-0217.
[18] EIA Global. "Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem," February 14, 2019, 6. https://eia-global.org/reports/20190214-search-reuse-destroy.
[19] "The Value of Refrigerant Recovery Incentives." ACHR: The News, April 10, 2017. https://www.achrnews.com/articles/134824-the-value-of-refrigerant-recovery-incentives.

such as A-Gas and Hudson Technologies possess this technology and have been using it to reclaim HFC blends for several years. This technology is not patented and is available on the market but several smaller reclaimers in Washington may not have acquired it.[20] NRDC believes that this mandate, along with other proposed measures to boost reclaim, may better enable smaller reclaimers to survive in the market after making necessary capital investments.

Ecology should also consider setting a sunset period for this program, at a point when reclaim and recovery rates are sufficiently high statewide. Revenues from product stewardship and Washington's cap-and-invest program may also ease costs of compliance for technicians and support operations of small reclaimers.

4) Costs associated with proper recycling and disposal of refrigeration equipment and other items containing refrigerants or other hydrofluorocarbons (HFCs); Responsibility for costs associated with recycling or reclamation of refrigerants

Currently, costs of proper management are distributed throughout the HFC custody chain. Homeowners in Washington, for example, typically pay the costs of EOL disposal for home refrigerators and air conditioners. Businesses typically pay service technicians to recover refrigerant and dispose of larger HVACR equipment. Service technicians bear costs of activities associated with recovery, such as cylinder transport, storage, and destruction fees for contaminated gas. These costs to technicians are a critical barrier in boosting refrigerant recovery rates at EOL.

A) Costs to service technicians during the recovery process

Service technicians, who recover and collect refrigerant from equipment at EOL, also bear the costs of refrigerant recovery. Technicians recover refrigerant using specialized refrigerant recovery equipment equipped with gauges, cooling fans, pumps, and compressors that enable technicians to remove refrigerant from a system and recover it into a pressurized tank for recycling or reuse. At equipment EOL, technicians typically transport recovered refrigerant to a distributor who then sells the recovered refrigerant to a reclaimer. Along the way, technicians may pay for transport, cylinder handling, and storage costs. Technicians usually give up this recovered refrigerant to distributors for free. In cases where the refrigerant is contaminated or mixed with other species of refrigerant, technicians may have to pay for the cost of destroying the refrigerant.

Technicians are stuck paying these costs because of legal and market forces. Under Section 608 of the Clean Air Act, technicians are prohibited from venting refrigerant into the atmosphere and therefore *must* recover refrigerant, even if they gain nothing (or pay costs) because they do so. EPA rarely enforces this rule at the small business level. As a result, the cost of the recovery process ends up harming *compliant* technicians the most. On the market side, technicians cannot pass on these costs to the consumer because of competition. When recovered refrigerant is eventually reclaimed and sold, technicians typically do not receive part of the cut.[21] The ultimate impact of these forces is that the supply of recovered material for reclaim or destruction is significantly smaller than the amount of refrigerant that should have been available to reclaimers.

Costs incurred by technicians provide further urgency to stimulate reclaim through a proposed Reclaimed Refrigerant Standard. In the early 2000s, when demand for reclaimed CFCs for use in servicing equipment rose, reclaimers made payments to technicians in exchange for recovered material. These

[20] Ernst, Bruce. NRDC meeting with A-Gas, July 14, 2021.
[21] From testimony during Ecology's July 8 commenting session.

payments covered the cost of recovery and provided a net benefit to technicians. In the years following these payments, reclaim volumes were substantially higher. Sharing reclaim profits with technicians sends a signal to technicians that recovered refrigerant is raw material with significant monetary value.

Even so, payments to technicians have not always spurred higher recovery rates. For example, even at times where reclaim companies paid service technicians $10 to $12 per pound of HCFC-22 recovered (2016-2018) it did not seem to induce better behavior; the rate of recovered refrigerant turned over for reclaim did not significantly rise.[22]

To further ease burdens on technicians, Ecology could require that distributors take back recovery cylinders at no cost to the technician, even if those cylinders contain mixed or contaminated refrigerant. This take-back agreement could be funded through product stewardship fees and would encourage recovery of refrigerant.

5) Challenges that businesses and equipment manufacturers may face in transitioning to safer refrigerants in existing equipment.

HB 1050 and HB 1112 (2019) place limits on the use of the most potent HFCs in several applications such as commercial refrigeration, cold storage, building chillers, and incoming limits on air conditioning and heat pumps. Most of these limits apply to *new* equipment. EPA will likely implement similar limits soon, following petitions by environmental groups, industry, and states.

None of these limits require the premature replacement of *existing* systems. However, should operators decide to switch out their equipment for a lower-GWP alternative, they may face challenges depending on the application. A common barrier among cooling applications is the limited availability of near drop-in solutions.

Some lower-GWP refrigerants, such as R-448A and R-449A, can be used as near drop-in substitutes in some existing equipment using extremely high GWP HFCs. Use of drop-in substitutes reduces total disruption to facility operations. These refrigerants have 60 percent lower GWPs than other HFCs used in similar applications but are still up to 1,400 times more climate damaging than ultra-low GWP refrigerants such as CO_2 (R-744). Even though the adoption of these lower-GWP alternatives is a step in the right direction, there are several EPA-approved ultra-low GWP refrigerants, such as hydrocarbons, ammonia, CO_2, and some hydrofluoroolefins (HFOs) that provide much more significant climate benefits. Their adoption is limited in *existing* equipment because they would require more capital and time investment.

Ecology could explore ways to incentivize the adoption of ultra-low GWP refrigerants, given their large environmental benefit and persistent market barriers for existing equipment. In particular, Ecology could support demonstrations of modular system replacements with ultra-low GWP refrigerants to help facilitate this transition with the least possible downtime.

A) Direct incentives for ultra-low GWP refrigerant adoption

To date, there are few programs that incentivize adoption of ultra-low GWP refrigerants. The primary barriers to robust incentives are high program costs and low private benefits from ultra-low GWP refrigerant adoption.

[22] Hudson Technologies. Meeting with NRDC, July 19, 2021.

One example of an incentive program for ultra-low GWP refrigerants is the Sacramento Municipal Utility District's (SMUD) Pilot Natural Refrigerant Incentive Program, which opened in 2017. This program provided up to $150,000 to accelerate the adoption of "natural" refrigerants such as CO_2, ammonia, and hydrocarbons. Even though the incentive was large relative to other HVACR-related projects, only two food retail customers participated in the pilot program.[23] SMUD struggled to attract customers because supermarkets operate on small profit margins. Shutting down portions of a store to swap out refrigeration systems is costly, irrespective of the cost of the new, climate-friendly system. Furthermore, unlike with energy efficiency measures that reduce both cost and emissions, SMUD and its customers received little private benefit from their investments.[24]

FRIP in California is another program that incentivizes adoption of ultra-low GWP refrigerants, with a focus on the food retail sector. CARB recently approved funding for 18 projects worth $1.2 million, ranging from installation of CO_2 transcritical systems to retrofitting existing R-404A systems with R-449A.[25] Ecology should closely monitor the rollout of FRIP to learn more about how a similar incentive program could work in Washington.

B) *Discussion of carbon crediting for refrigerant management and ultra-low GWP refrigerant adoption*

There has been widespread interest among stakeholders in offering certified carbon credits as an incentive to adopt ultra-low GWP refrigerants. NRDC, however, believes that carbon credits are *not* an appropriate tool to incentivize installation of ultra-low GWP equipment. In 2019, the Washington State Legislature enacted prohibitions on the use of high-GWP refrigerants in new equipment such as residential refrigeration products, foam blowing agents, and chillers.[26] The AIM Act and forthcoming state regulations will further restrict the use of high-GWP refrigerants in new equipment. The presence of existing and forthcoming laws prohibiting high-GWP use in new equipment gives consumers little choice but to transition to lower- and ultra-low GWP refrigerants over time. Furthermore, issuing carbon credits for adoption of ultra-low GWP refrigerants will trade away any environmental benefit of HFC phasedown to a different polluting industry.

Beyond offering carbon credits for adoption of ultra-low GWP refrigerants, stakeholders have proposed that credits be used in the following ways:

- Verified destruction of ODS refrigerants such as HCFC and CFC;
- Verified destruction of HFC refrigerants; and
- Use of reclaimed HFC refrigerant.

Certified carbon credits for destruction of ODS refrigerants already exist. Under California's cap-and-trade legislation established under Assembly Bill (AB) 32, verified destruction of ODS gases can be certified as carbon credits. These credits can then contribute to emissions compliance or be sold to other

[23] SMUD. "SMUD Pilot Natural Refrigerant Incentive Program," May 6, 2017. https://www.smud.org/-/media/Documents/Business-Solutions-and-Rebates/Refrigerant-Pilot-Program-Summary.ashx#:~:text=SMUD's%20Pilot%20Natural%20Refrigerant%20Incentive,GWP)%20refrigerant%20to%20a%20natural.
[24] Hammond, Ryan. Conversation between SMUD and NRDC, June 25, 2021.
[25] "FRIP Program Awarded Projects | California Air Resources Board." Accessed July 21, 2021. https://ww2.arb.ca.gov/our-work/programs/FRIP/frip-program-awarded-projects.
[26] Washington State House of Representatives Office of Program Research. "Bill Analysis - HB 1050." Environment & Energy Committee, January 15, 2021. http://lawfilesext.leg.wa.gov/biennium/2021-22/Pdf/Bill%20Reports/House/1050%20HBA%20ENVI%2021.pdf?q=20210712060643.

companies looking to offset their emissions. CARB is planning to extend this crediting program to HFC refrigerants in the near term.[27] The recently announced Mexico Halocarbon Protocol includes similar provisions for the destruction of ODS gases and allows for crediting for the verified destruction of HFCs.[28]

Ecology should be wary of encouraging destruction of HFCs as opposed to their reclamation. In the coming years, EPA will restrict the amount of HFC that can be imported and produced, phasing down the amount of HFC in circulation. Destruction of HFCs would not reduce demand for virgin refrigerant and would not make acceleration of HFC phasedown more attractive. Reclaimed refrigerant, however, reduces demand for virgin refrigerant and may make acceleration of the phasedown schedule possible.

Reclaimed certified carbon credits *did* exist through the American Carbon Registry (ACR), but crediting was suspended with the passage of the AIM Act.[29] It appears that ACR is waiting to assess the final version of the EPA allocation rule before deciding whether it is appropriate to continue certifying carbon credits for reclaim and adoption of ultra-low GWP equipment.[30] Carbon credits for reclaimed refrigerant should not be pursued before Ecology can assess the final scope and ambition of EPA's allocation rule.

One application where Ecology could consider carbon credits is for HFCs contained in insulating foams. The AIM Act does not give EPA authority to mandate the recovery of HFCs contained in insulating foams, although state governments are still free to do so. Specifically, Ecology could consider creating a program to generate certified carbon credits for the destruction or reclaim of HFCs contained in insulating foams in HVACR appliances taken off the grid under utility or state energy efficiency programs. Incentivizing action on foams through carbon credits raises the ambition of HFC phasedown at the state level and boosts these programs' cost effectiveness and environmental benefit.

This carbon credit incentive may also allow for a reduction in the product stewardship fee applied to virgin HFC sold in Washington that would have been spent managing HFCs contained in insulating foam at equipment EOL.

6) Examples from other states or jurisdictions with incentives encouraging reuse or recycling of refrigerants, as well as users' experience with those programs.

Much of the information below comes from the Air Conditioning, Heating, and Refrigeration's (AHRI) Institute's "Review of Refrigerant Management Programs" 2016 report, as well as "Federal Policy to Manage Refrigerant Banks," a report prepared for NRDC by Columbia University School of International and Public Affairs students that draws on recent research and interviews with experts. This report contains further references to government, non-profit, and industry documents about EOL refrigerant management.

A) California

California has more robust inspection, maintenance, and recordkeeping requirements than the rest of the United States for stationary air conditioning and refrigeration systems. California charges annual

[27] Taddonio, Kristen. Conversation on Carbon Offsets, June 28, 2021.
[28] Climate Action Reserve. "Mexico Halocarbon Protocol," June 2021. http://www.climateactionreserve.org/how/protocols/mexico-halocarbon/.
[29] American Carbon Registry. "Certified Reclaimed HFC Refrigerants." Carbon Accounting. Accessed July 20, 2021. https://americancarbonregistry.org/carbon-accounting/standards-methodologies/certified-reclaimed-hfc-refrigerants.
[30] 86 FR 27150

operating fees to owners of large commercial and industrial refrigeration equipment. Revenues from these fees fund implementation, enforcement, and reporting activities in the state.

California is an interesting case study for how it funds incentives for refrigerant management. California pulls funds from the Greenhouse Gas Reduction Fund, the revenue pool for the state's cap-and-trade auction proceeds. CARB used $1 million from this fund to develop the F-Gas Reduction Incentive Program (FRIP). FRIP is aimed at easing the transition to low-GWP refrigerants in the food retail sector.[31] The program recently approved funding for 18 projects from companies such as ALDI and Costco. Most incentive awardees will install CO_2 transcritical systems in their stores, and a few applicants will retrofit their equipment with lower-GWP HFCs. California's AB 32 further credits destruction of ODS refrigerants as sellable credits on the offset market.

B) Australia

Australia operates a product stewardship program that extends responsibility for EOL product management to producers and importers. This program is funded by import levies on ODS and HFC refrigerants and is managed by Refrigerant Reclaim Australia. Small importers pay flat fees on regulated refrigerants, while large importers pay fees per kilogram of refrigerant imported.

Technicians charge customers for the costs associated with recovering refrigerant, but also receive rebates for returning recovered refrigerant to wholesalers.

A major challenge in Australia is that importers of HFCs have significantly stockpiled virgin HFC gas. Stockpiles have discouraged refrigerant reclamation processes in the country. Although recovery rates for HFCs are as high as 60 percent, the reclaim rate is only .005 percent. It is most common to destroy recovered HFCs in Australia. Washington can avoid similar problems by mandating the use of reclaimed refrigerant when servicing equipment, following the Reclaimed Refrigerant Standard proposal detailed in previous sections.[32]

C) Canada

Canada uses a voluntary EPR program that is funded by levies charged to refrigerant manufacturers and suppliers. Because of the voluntary nature of the program, smaller companies and suppliers have historically not participated in the program. These smaller entities have claimed that they cannot afford to penalize themselves under a voluntary system. Non-participants therefore have an advantage in the market because they can sell their products at lower cost to the consumer.

D) European Union

The European Union's Waste Electrical and Electronic Equipment (WEEE) directive requires true EPR, which gives producers both the financial and physical responsibility of recycling HVACR equipment. WEEE has been extremely successful in generating refrigerator recycling rates as high as 85 percent, reducing emissions from ODS and toxins, and encouraging refrigerator reuse and adoption of ultra-low

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[31] North American Sustainable Refrigeration Council. "New CARB Proposal Represents Successful Collaboration with California Retailers." North American Sustainable Refrigeration Council, February 26, 2020. https://nasrc.org/articles1/2020/2/26/new-carb-proposal-represents-successful-collaboration-with-california-retailers.

[32] Braverman, Sarah, Day, Allison, Goodgal, Rachel, Hu, Carol, Patten, Rachael Grace, Saad, Charles, Solfest, Andrew, Woodruff, Tim, and Yurova, Alina. "Federal Policy to Manage Refrigerant Banks." Natural Resources Defense Council, April 2, 2021, 24. https://00b4e11a-a0e5-44f0-a4c5-d4dfe41c1ebc.filesusr.com/ugd/571f98_223f3a6fe3d84886945fd7b08ce3d7ca.pdf.

GWP refrigerants such as hydrocarbons.[33] Ecology may choose to implement a similar program that contains the financial responsibility of WEEE and Washington's E-Cycle program and that delegates physical recycling responsibility to Washington's established network of recyclers and service technicians who can assist with refrigerator disposal.

In France, distributors of HFCs are required to collect, store, and deliver used HFCs to reclamation and destruction facilities, at no cost to equipment operators or technicians. The program requires that distributors participate, without incentives for participation.[34]

In 2020, Europe implemented a ban on servicing equipment with virgin HFCs with GWPs greater than 2,500, functionally mandating the use of reclaimed refrigerant in existing equipment. This ban caused Chemours and Honeywell, two of the world's largest chemical manufacturers, to cease supplying R-404A and R-507A in Europe. Virgin refrigerant quickly reached cost parity with reclaimed refrigerant.[35]

E) Japan

Japan uses product stewardship to fund EOL management of refrigerants in motor vehicle air conditioners. Lawmakers charge this fee to consumers at the time of purchase in order to reduce the incentive to evade regulations at EOL.

Japan does not have financial incentives for refrigerant management but has strict punishments for noncompliance.[36]

Conclusion

NRDC looks forward to the implementation of HB 1050 and the development of a robust end-of-life refrigerant management program. For further information or with questions about NRDC's comments, please contact Christina Theodoridi, ctheodoridi@nrdc.org.

[33] Nicol, Scott and Thompson, Shirley. "Policy Options to Reduce Consumer Waste to Zero: Comparing Product Stewardship and Extended Producer Responsibility for Refrigerator Waste." Sage Journals, June 1, 2007. https://journals.sagepub.com/doi/abs/10.1177/0734242X07079152.
[34] "Federal Policy to Manage Refrigerant Banks." Natural Resources Defense Council, April 2, 2021, 18.
[35] *Id.* at 24.
[36] *Id.* at 19.