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Refrigerant Management Rule Revisions: Is Washington University Prepared?

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Agenda

- Introduction to refrigerant rules and basic refrigerant types
- Refrigerant phase out or phase down
  - EPA's Significant New Alternatives Policy (SNAP) Program
  - Montreal Protocol
- Appliance servicing requirements
  - EPA's 11/18/2016 rule revisions
- Tips for facilities and HVAC/R contractors
- Q&A

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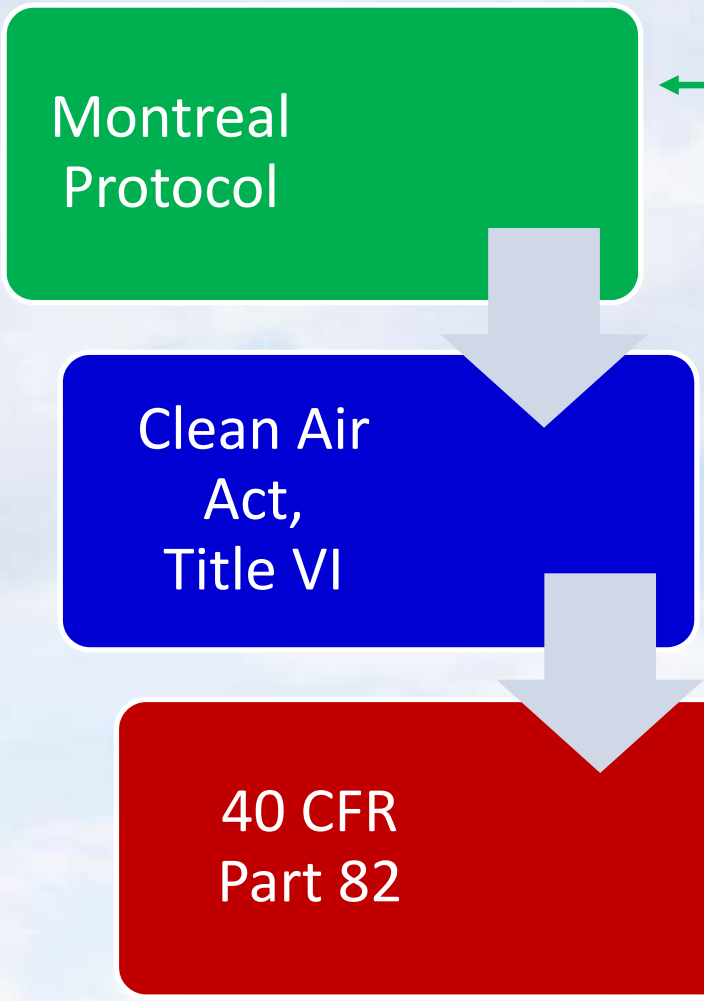
Introduction to Environmental Requirements for Refrigerants



- International treaty – established in 1987 in response to hole in ozone layer that forms over Antarctica each year
  - Targets ODS, including CFCs and HCFCs
  - Amended several times using "worst first" approach; recently amended to target HFCs
- U.S. law or statute – gives EPA authority to develop rules to implement requirements in Montreal Protocol
- EPA rule – what you have to comply with on day-to-day basis

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Basic Refrigerant Types (1 of 2)

- CFCs – chlorofluorocarbons (e.g., R-11, R-12)
  - 1st generation refrigerants
  - Class I ozone depleting substances (ODSs) with ozone depletion potential (ODP) > 0.2
  - Production phased out since 1996
- HCFCs – hydrochlorofluorocarbons (e.g., R-22, R-141b, R-142b)
  - 2nd generation refrigerants
  - Class II ODSs with ODP < 0.2
  - Production being phased out by 2020 (R-22 phase out started in 2010)

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Basic Refrigerant Types (2 of 2)

- HFCs – hydrofluorocarbons (e.g., R-134a, R-407C, R-410A)
  - 3rd generation refrigerants
  - non-ODS, but several have high global warming potential (GWP)
  - Production targeted for future phase down
- Next generation refrigerants
  - Non-ODS and low GWP
  - Hydrocarbons - e.g., R-290 (propane), R-600a (isobutane)
  - Hydrofluoroolefins (HFOs) – e.g., R-1234yf
  - HFC/HFO blends - e.g., R-448A, R-449A

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How Do EPA's Refrigerant Rules Impact Facilities and HVAC/R Technicians/Contractors?

1. Phase Out of Specific Refrigerants (Subparts A, C, G, & I)

- CFCs phased out of production in 1996 (e.g., R-11, R-12)
- HCFCs being phased out of production (e.g., R-22) by 2020
- HFCs now targeted for phase down
- SNAP Program approves/disapproves substitutes
- Reduces supply and increases cost

2. Required Practices When Working on AC Units (Subparts B & F)*

- Technician certifications
- Evacuation & recovery (no venting)
- Disposal requirements
- Sales restrictions
- Leak repair provisions for units with full charge ≥ 50 lbs
- Promotes recovery, recycling, & reclamation

*Commonly referred to as Clean Air Act Section 609 (mobile) and Section 608 (stationary) provisions

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Relevance to Industrial Sites

- Phase out of HCFCs and HFCs will increase refrigerant costs and accelerate equipment retrofits/replacements
- Non-compliance with the leak repair provisions can lead to steep penalties & forced retrofits/replacements
  - Earthgrains Baking Companies - $5.25 million
  - Bristol-Myers Squibb - $3.65 million
  - American Seafoods Group - $9-$15 million
- Revised leak repair provisions represent significant raising of the bar for recordkeeping

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1. Developments in Refrigerant Phase Out Schedules

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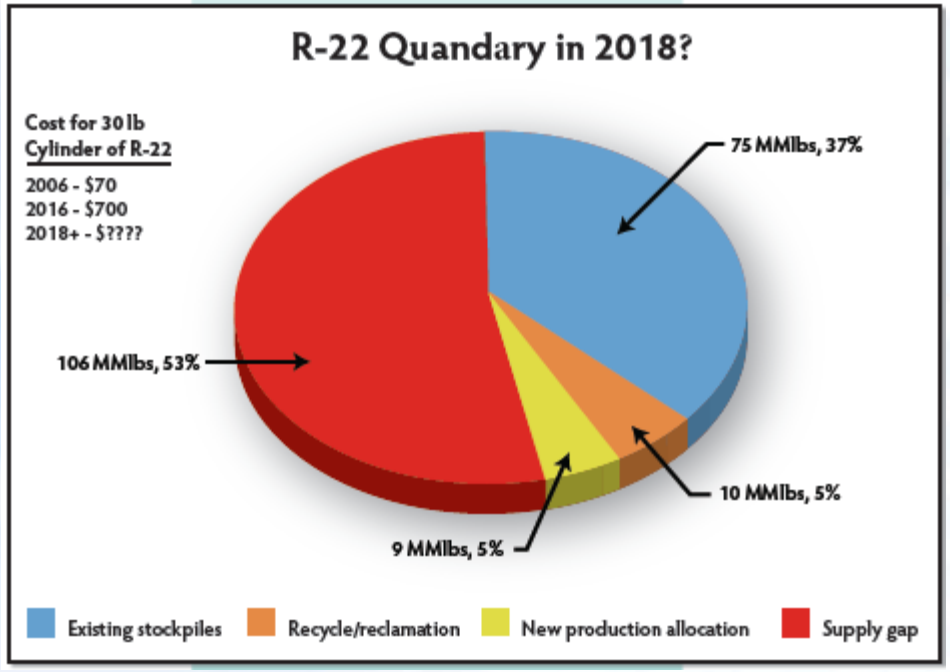
HCFC Phase Out is Here

- HCFC production phase out schedule
  - 2015 = 90%
  - 2020 = 99.5% overall and 100% for R-22 & R-142b
  - 2030 = 100%
- R-22 quandary?
  - EPA production allocations = 13 million lbs (2017), 9 million lbs (2018), & 4 million lbs (2019)
  - EPA estimates recycle/ reclamation < 10 million lbs/year in 2016
  - Represent only a fraction of the ~200 million lb/year service need in the U.S.
- Costs for R-22 have already risen 10x since 2006



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The Latest on R-22

- R-22 continues to be most commonly used refrigerant across all industry sectors
  - Installed capacities at most sites range from several hundred lbs to several thousand lbs
- Most retrofits/retirements are not planned
- R-22 prices have returned from $25-$35/lb levels to $10-$17/lb levels
  - Due largely to success of R-407C as replacement in AC applications

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HFCs are the New Target

- HFCs (e.g., R-134a, R410A), which are the most common replacement for HCFCs, are the new target since they are potent GHGs
- HFC targeting mechanisms
  - EPA's SNAP Program
  - Kigali Amendment to Montreal Protocol
  - Expansion of 40 CFR 82, Subpart F (i.e., CAA Section 608) provisions to non-ODS substitutes
    - Will cover in Section 2

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HFCs are the New Target – SNAP Program

- Stems from former President Obama's Climate Action Plan, 6/2013
  - Obtained significant private sector commitments to reduce reliance on HFCs from HFC producers, appliance manufacturers, and other end-users
  - Avoids >700MM metric tons of CO_2e emissions
- EPA removed SNAP approval of several HFCs in specific end-uses
  - SNAP Rules 20 (2015) and 21 (2016)
  - Court vacated Rule 20 on 8/8/2017
    - DC Circuit denied Chemours/Honeywell appeal on 1/27/2018

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HFCs are the New Target – Kigali Amendment

- HFC phase down within Kigali Amendment to Montreal Protocol, 10/15/2016
  - 2019 - 10%
  - 2024 - 40%
  - 2029 - 70%
  - 2034 - 80%
  - 2036 - 85%
  - Relative to 2011-2013 HFC baseline + 15% of HCFC/CFC baseline
- Trump Administration expected to ratify since has industry backing?

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How Should Facilities Prepare for Impending Refrigerant Phase Outs?

- Facility managers must develop inventory of appliances (age, size, refrigerant type) to quantify exposure to expected rise in refrigerant costs
- Watch for availability of next generation refrigerants (e.g., HCs, HFOs, HFO/HFC blends)
  - Obtain input from appliance manufacturers and HVAC/R contractors
- Analyze new AC/R unit installations and retrofits based on available cost data and unit lifetimes
  - If R-407C is facing an impending phase down, does it make sense to switch your R-22 unit to R-407C?

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2. Developments in Required Work Practices when Servicing Refrigerant Containing Appliances

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Subpart F Matrix by Appliance & Refrigerant Type (prior to rule revision)

Category	Venting Prohibition	Sales Restrictions	Evacuation Req's	Technician Certs	Disposal Req's	Leak Repair Provisions
Appliances w/ Non-ODS Substitutes	Yes (unless listed as exempt)	No	No	No	No	No
Small Appliances (≤ 5 lbs ODS)	Yes	Yes	Yes (specific)	Yes	Yes (specific)	No
Medium Appliances (> 5 lbs & < 50 lbs ODS)	Yes	Yes	Yes	Yes	Yes (no explicit records)	No
Large Appliances (≥ 50 lbs ODS)	Yes	Yes	Yes	Yes	Yes	Yes

Technician Certification Requirements (prior to rule revision)

Refrigerant Type	Appliance Capacity	Required Certification Level
All types of refrigerant	Small appliances (≤ 5 lbs)	Type I or Universal[a]
Very high-pressure refrigerants (e.g., R-13, R-23, R-503, R-508A, R-508B)	> 5 lbs	Type II or Universal
High-pressure refrigerants (e.g., R-22, R-407A, R-407C, R-410A, R-502)	> 5 lbs	Type II or Universal
Medium-pressure refrigerants (e.g., R-12, R-114, R-124, R-134a, R-500)	> 5 lbs	Type II or Universal
Low pressure refrigerants (e.g., R-11, R-113, R-123, R-245fa)	> 5 lbs	Type III or Universal

[a] Persons who dispose of small appliances, MVACs, & MVAC-like appliances are not required to be certified.

- Technicians must keep copy of their certificate at their place of business, 82.161(a)(4)(i)
- The above are separate and distinct from the motor vehicle air conditioner (MVAC) technician certification requirements in 40 CFR 82, Subpart B

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Leak Rate Provisions for Comfort Cooling Appliances – Overview (prior to rule revision)

- Applicable to units with full charge ≥ 50 lbs ODS-containing refrigerant
  - Applicability determined on a circuit-by-circuit basis
- If the leak rate ≥ applicable "trigger rate" (15% for comfort cooling appliances)
  - The leak should be repaired within 30 days*, or
  - The system should be retrofitted (within 1 year), or
  - The system should be retired from service (within 1 year)
- *One option to extend repair window – mothballing (evacuation & shutdown)
- Servicing records required
  - Date & type of service
  - Amount of refrigerant added
  - Date & amount of refrigerant purchased (if add own refrigerant)

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Leak Rate Calculation – It's a Projection of Amount Lost if Not Repaired for a Year

EPA Leak Rate Calculation for Appliances with Full Charge ≥ 50 lbs – Annualizing Method

Step 1. Take the pounds of refrigerant added to bring the unit to a full charge, and divide that by the number of pounds the unit holds at full charge.

Step 2. Take the shorter of:
A) the number of days that have passed since the last day refrigerant was added OR
B) 365 days
and divide that number into 365 days/year

$$\text{Leak Rate (\% per year)} = \frac{\text{Refrigerant Added (lbs)}}{\text{Full Charge (lbs)}} \times \frac{365\ \left(\frac{\text{days}}{\text{year}}\right)}{\text{A or B (days)}} \times 100$$

Step 3. Multiply the result from Step 1 by the result from Step 2.

Step 4. Multiply the number calculated in Step 3 by 100 to calculate a percentage.

Rule also allows for use of the rolling average method, but the annualizing method is, by far, the most commonly used method. Note also that only one leak rate calculation method can be used per facility.

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Leak Rate Calculation Example

- Determines the amount of refrigerant that would leak out in a year if nothing done
- Example (using "Annualizing Method"):
  Day 1 - Unit fully charged with 250 lbs of R-22
  Day 8 - Unit found to have lost 2 lbs of R-22

  Leak Rate = 41.7% =

$$\left(\frac{\text{2 lbs refrigerant added}}{\text{250 lbs refrigerant in full charge}}\right)\times\left(\frac{\text{365 day/yr}}{\text{7 days since refrigerant last added}}\right)\times 100$$

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Refrigerant Servicing Rule Revisions

- Rule represents overhaul of 40 CFR 82, Subpart F
- Finalized on 11/18/2016 (81 FR 82272)
- Includes 3 primary categories of changes
  - Extension to non-ODS containing substitutes
  - Revised appliance disposal requirements
  - Revised leak repair provisions for appliances with full charge ≥ 50 lbs
- Staggered compliance dates of 1/1/2017, 1/1/2018, & 1/1/2019

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Extension to Non-ODS Substitutes, 1/1/2017

- Substitutes are defined as refrigerants, with the following subcategories:
  - Non-exempt substitutes - subject to all provisions of rule, including sales restrictions, evacuation, recovery/recycling equipment, technician certification, leak repair, and reclamation provisions
  - Exempt substitutes - exempt from all provisions of rule when used in approved applications

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82.154(a) Venting Prohibition.

82.154(a)(1)

No person maintaining, servicing, repairing, or disposing of an appliance or industrial process refrigeration may knowingly vent or otherwise release into the environment any refrigerant from such appliances. Notwithstanding any other provision of this subpart, the following substitutes in the following end-uses are exempt from this prohibition and from the requirements of this subpart:

82.154(a)(1)(i)

Carbon dioxide in any application;

82.154(a)(1)(ii)

Nitrogen in any application;

82.154(a)(1)(iii)

Water in any application;

82.154(a)(1)(iv)

Ammonia in commercial or industrial process refrigeration or in absorption units;

82.154(a)(1)(v)

Chlorine in industrial process refrigeration (processing of chlorine and chlorine compounds);

82.154(a)(1)(vi)

Hydrocarbons in industrial process refrigeration (processing of hydrocarbons);

82.154(a)(1)(vii)

Ethane (R-170) in very low temperature refrigeration equipment and equipment for non-mechanical heat transfer;

82.154(a)(1)(viii)

Propane (R-290) in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning and heat pumps; vending machines; and effective January 3, 2017, self-contained commercial ice machines, very low temperature refrigeration equipment, and water coolers;

82.154(a)(1)(ix)

Isobutane (R-600a) in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; and vending machines;

82.154(a)(1)(x)

R-441A in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning; heat pumps; and vending machines.

Extension to Non-ODS Substitutes – Highlights

- Newly manufactured recovery/recycling equipment must be certified, 1/1/2017 [82.158]
- Restriction on sale of refrigerant, 1/1/2017 & 1/1/2018 [82.154(c)-(d)]
- Technicians must be certified, 1/1/2018 [82.161(a)]
- Evacuation requirements for disposal or opening of appliances, 1/1/2018 [82.155 & 82.156(a)-(d)]
- Leak repair provisions as they apply to appliances with full charge ≥ 50 lbs refrigerant, 1/1/2019 [82.157]

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Extension to Non-ODS Substitutes – Common Problem Areas

- Evacuation level issues
  - Technicians not meeting proper evacuation level, which varies by refrigerant and size of appliance
  - Lack of documentation when using alternative evacuation levels
- Using recovery equipment that has not been certified for a particular refrigerant
  - Pay attention to certification labels!

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Required Evacuation Levels

Refrigerant Type	Appliance Capacity	Required Evacuation Level[a,b,c]	Recovery Eqpt. Cert. Class per AHRI 740
All types of refrigerant	Small appliances (≤ 5 lbs)	4 inches mercury (inHg), 90% (if compressor operating), or 80% (if compressor not operating)	Varies by refrigerant type (see below)
Very high-pressure refrigerants (e.g., R-13, R-23, R-503, R-508A, R-508B)	> 5 lbs	0 inHg	VI
High-pressure refrigerants (e.g., R-22, R-407A, R-407C, R-410A, R-502)	> 5 lbs & < 200 lbs	0 inHg	IV (e.g., R-22) **OR** V (e.g., R-410A)
	≥ 200 lbs	10 inHg	
Medium-pressure refrigerants (e.g., R-12, R-114, R-124, R-134a, R-500)	> 5 lbs & < 200 lbs	10 inHg	II (e.g., R-114) **OR** III (e.g., R-134a)
	≥ 200 lbs	15 inHg	
Low pressure refrigerants (e.g., R-11, R-113, R-123, R-245fa)	> 5 lbs	25 millimeters mercury (mmHg) absolute (25,000 microns absolute)	I

[a] Per **Table 1** of 40 CFR 82.156(a) for > 5 lb appliances & 40 CFR 82.156(b) for small (≤ 5 lb) appliances. Assumes recovery/recycling equipment used is manufactured on or after 11/15/1993. When using recovery/recycling equipment manufactured prior to 11/15/1993, less stringent evacuation requirements apply to medium-pressure appliances > 5 lbs (4 inHg) and high-pressure appliances ≥ 200 lbs (4 inHg).

[b] All vacuum levels measured relative to atmospheric pressure of 29.9 inHg (i.e., gauge pressure), unless otherwise specified.

[c] Alternative evacuation levels apply to > 5 lb appliances in limited circumstances, including A) if, due to leaks, the above evacuation levels are not attainable or would substantially contaminant the refrigerant being recovered, B) if dehydration evacuation to the environment is not to be performed when non-major repairs are complete, and C) for oil changes.

Major repairs - Repairs that involve removal of the compressor, condenser, evaporator, or auxiliary heat exchange coil of an appliance; or any repair that involves uncovering an opening of more than 4 square inches of "flow area" for more than 15 minutes.
Dehydration evacuation - After repair complete, typically must evacuate to atmosphere beyond these levels (e.g., down to 5,000 to 400 microns absolute) using vacuum pump to ensure moisture and non-condensable gases are removed; not regulated by 40 CFR 82.

No significant change other than extension to non-ODS refrigerants.

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Revised Small Appliance Disposal Requirements

- Two options for final processors (e.g., scrap recyclers, landfills) when disposing of small (≤ 5 lb) appliances*
  - Option 1 – evacuate and recover refrigerant
  - Option 2 – verify that refrigerant has been evacuated previously via A) signed statements or B) contract
- 2016 rule
  - Relocates these provisions from 82.156(f) & 82.166(i) to 82.155
  - Under Option 2, adds requirement to obtain signed statement when all refrigerant in an appliance has "leaked out" prior to delivery due to unavoidable occurrences
  - Effective date = 1/1/2017 for ODS-containing refrigerants and 1/1/2018 for non-exempt substitutes

*Also applies to disposal of MVACs and MVAC-like appliances

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New Medium Appliance Disposal Requirements, 1/1/2018

- 2016 rule adds explicit technician recordkeeping requirements for disposal of appliances with full charge > 5 lbs and < 50 lbs [82.156(a)(3)]
  - Company name
  - Location of the appliance
  - Date of recovery
  - Type of refrigerant recovered for each appliance
  - The quantity of refrigerant, by type, recovered from all disposed appliances in each calendar month
  - The quantity of refrigerant, by type, transferred for reclamation and/or destruction
  - The person to whom it was transferred
  - The date of transfer
- Owners/operators only required to maintain these records if directly employ technicians

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Appliance Disposal Requirements – Common Problem Areas

- Not having records associated with appliance disposal events
- Not providing signed statements or having required contract language in place with scrap recycler
- Not differentiating between appliances that “leaked out” versus those that required evacuation

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Revisions to Leak Repair Provisions for ≥ 50 lb Units - Highlights, 1/1/2019

- Extends applicability to appliances that contain non-exempt substitutes (e.g., HFCs)
  - 10/1/2018 proposed rule to revisit this portion of the new rule
- Lowers allowable leak (or repair "trigger") rates [82.157(c)(2)]
  - Comfort cooling & other units - 15% to 10%
  - Commercial refrigeration – 35% to 20%
  - Industrial process refrigeration - 35% to 30%

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Revisions to Leak Repair Provisions for ≥ 50 lb Units – Highlights, 1/1/2019

- Initial and follow-up verification testing
  - Now required for all appliance types, including comfort cooling and commercial refrigeration (was only required for industrial units previously)
  - Shortens window for performing follow-up verification test from 30 days to 10 days of initial verification test or of the appliance achieving normal operating characteristics and conditions
- Standard list of extensions to 30-day repair window for all appliance types
  - Mothballing, necessary parts unavailable, radiological contamination issues, & other rules make repair within window impossible
  - 120-day repair window if industrial process shutdown (IPS) required to make repair still reserved for IPRAs

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Revisions to Leak Repair Provisions for ≥ 50 lb Units - Highlights, 1/1/2019

- Establishes leak inspection requirements if exceed allowable leak rates [82.157(g)]
  - Commercial/industrial process refrigeration ≥ 500 lbs – quarterly, until 4 consecutive quarters w/ no leaks above allowable leak rate
  - All other units ≥ 50 lbs – once per calendar year, until 1 year w/ no leaks above allowable leak rate
  - Must be performed by certified technicians
  - Not required if equipped with automatic leak detection system (ALDS)

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Revisions to Leak Repair Provisions for ≥ 50 lb Units - Highlights, 1/1/2019

- Can avoid follow-up leak inspection requirements if employ ALDS [82.157(g)(4)]
- Must directly detect refrigerant in air, monitor its surrounding in another manner, or monitor appliance conditions
- Must be audited or calibrated annually
- If detect refrigerant in air:
  - Appliance must be located indoors
  - Have 10 ppm accuracy
  - Have 100 ppm alert level
- Other systems must alert when lose 50 lbs or 10% of full charge, whichever is less
- If only used to monitor portion of appliance, then inspections apply to remainder

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Revisions to Leak Repair Provisions for ≥ 50 lb Units - Highlights, 1/1/2019

- Reporting required for appliances ≥ 50 lbs that leak more than 125% of their full charge in calendar year [82.157(j)]
  - "Chronic leaker" provision
  - Calculation = amount added / full charge (do not use standard leak rate calculation methods for this purpose)
  - Due 3/1 of following year

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Revisions to Leak Repair Provisions for ≥ 50 lb Units - Recordkeeping [82.157(l)], 1/1/2019

- Expanded servicing records (ID/location of appliance, date of service, parts of appliance serviced and type of service made to each part, name of person performing the service, amount and type of refrigerant added to or removed, full charge, leak rate, leak rate method used)
- Expanded full charge records (full charge, method used, revisions, and date of revisions) for all full charge methods
- Expanded verification test records (location of repairs tested, date, type, and results)
- Adds explicit records for mothballing (date and return to service)
- Adds explicit records for seasonal variance (dates of removal and corresponding addition)
- Adds records of leak inspections (date, method used, leak locations, and certification that all visible parts inspected)
- Adds records for automatic leak detection systems (installation, annual audit and calibration, and date/location of leaks detected)
- Purged refrigerant records (when exempting from leak rate calculations)
- Copies of reports and requests submitted to EPA
- Copies of retrofit/retirement plans

Red = New

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Revisions to Leak Repair Provisions for ≥ 50 lb Units – Clarifies Who is Responsible for Servicing Records [82.157(l)(2)], 1/1/2019

(2) Owners or operators must maintain a record including the following information for each time an appliance with a full charge of 50 or more pounds is maintained, serviced, repaired, or disposed of, when applicable. If the maintenance, service, repair, or disposal is done by someone other than the owner or operator, that person must provide a record containing the following information, with the exception of (l)(2)(vii) and (viii) of this section, to the owner or operator:

- Similar language in leak inspection (l)(3) and verification testing (l)(5) recordkeeping provisions

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Revisions to Leak Repair Provisions – Notifications & Reporting

- Eliminates one-time notification of acquisition of certified recovery/recycling equipment (effective date = 1/1/2017)
- Requires notifications/reports to be submitted electronically to 608reports@epa.gov [82.157(m)] (effective date = 1/1/2019)
  - e.g., repair window extension requests, chronic leaker reports
  - Can use now per EPA

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Revisions to Leak Repair Provisions – Common Problems Areas

- Improper categorization of appliances as IPRAs
- No documentation of full charge method
- Assuming HVAC contractor knows what records are required
  - Do not blindly rely on contractor service forms!
- Lack of specific leak location documentation
- Incomplete leak repair verification testing records
- Not calculating leak rates (under approach that all leaks fixed within 30 days)

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Subpart F Matrix by Appliance & Refrigerant Type (after rule revision)

Category	Venting Prohibition	Sales Restrictions	Evacuation Req's	Technician Certs	Disposal Req's	Leak Repair Provisions
Appliances w/ Exempt Substitutes	No	No	No	No	No	No
Small Appliances (≤ 5 lbs ODS or Non-Exempt Substitute)	Yes	Yes Applies to Non-Exempt Subs on: 1/1/17 – Used Ref 1/1/17 – Appliances 1/1/18 – New Ref	Yes (specific) Applies to Non-Exempt Subs on: 1/1/18	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes (specific) "Leaked out" Records Req'd on: 1/1/17 – ODS 1/1/18 – Non-Exempt Subs	No
Medium Appliances (> 5 lbs & < 50 lbs ODS or Non-Exempt Substitute)	Yes	Yes Applies to Non-Exempt Subs on: 1/1/17 – Used Ref 1/1/17 – Appliances 1/1/18 – New Ref	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes Explicit Records Req'd on: 1/1/18 – ODS 1/1/18 – Non-Exempt Subs	No
Large Appliances (≥ 50 lbs ODS or Non-Exempt Substitute)	Yes	Yes Applies to Non-Exempt Subs on: 1/1/17 – Used Ref 1/1/17 – Appliances 1/1/18 – New Ref	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes Applies to Non-Exempt Subs on: 1/1/18	Yes 82.156(i) Applies thru: 12/31/18 – ODS 82.157 Applies starting: 1/1/19 – ODS 1/1/19 – Non-Exempt Subs

Late Breaking News – New EPA Proposal

- Stems from 8/10/2017 letter from EPA to two industry groups
- Proposed rule issued on 10/1/2018
  - Proposing to limit leak repair provisions to ODS refrigerants
  - Requesting comment on:
    - Full roll back for non-ODS refrigerants (all but the venting prohibition)
    - 6-12 month extension to 1/1/2019 compliance date for non-ODS refrigerants if rule not finalized in reasonable time prior to 1/1/2019

Does NOT impact rule as it relates to ODS refrigerants!

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How Should Facilities Prepare for Subpart F Revisions?

- Use EPA required work practices previously reserved for ODS-containing refrigerants (e.g., R-12, R-22) on non-ODS substitutes (e.g., R-134a, R-410A)
  - Certified technicians
  - Certified recovery/recycling equipment
  - Required refrigerant evacuation levels
- Implement changes to appliance disposal recordkeeping system
- Prepare for new leak repair provisions on ≥ 50 lb units
  - Conduct initial and follow-up verification testing for all leaks
  - Implement system to maintain new records
  - Test drive now!

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Key Components of Refrigerant Compliance Program

- High-level procedure/policy
- Accurate appliance inventory
  - Focus on large (≥ 50 lb) appliances
- Comprehensive service/repair form
- Comprehensive appliance disposal form
- Leak repair tracking tool
- Refrigerant transfer tracking tool

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Examples of Components of Washington University's Refrigerant Compliance Program

- Current:
  - Appliance Inventory
  - Service Compliance Form
- Future:
  - Updated Service Form
  - Appliance Disposal Form
  - Notification Form Letters
  - Cylinder Tracking
  - Refrigerant Tracking Tool (Trinity)

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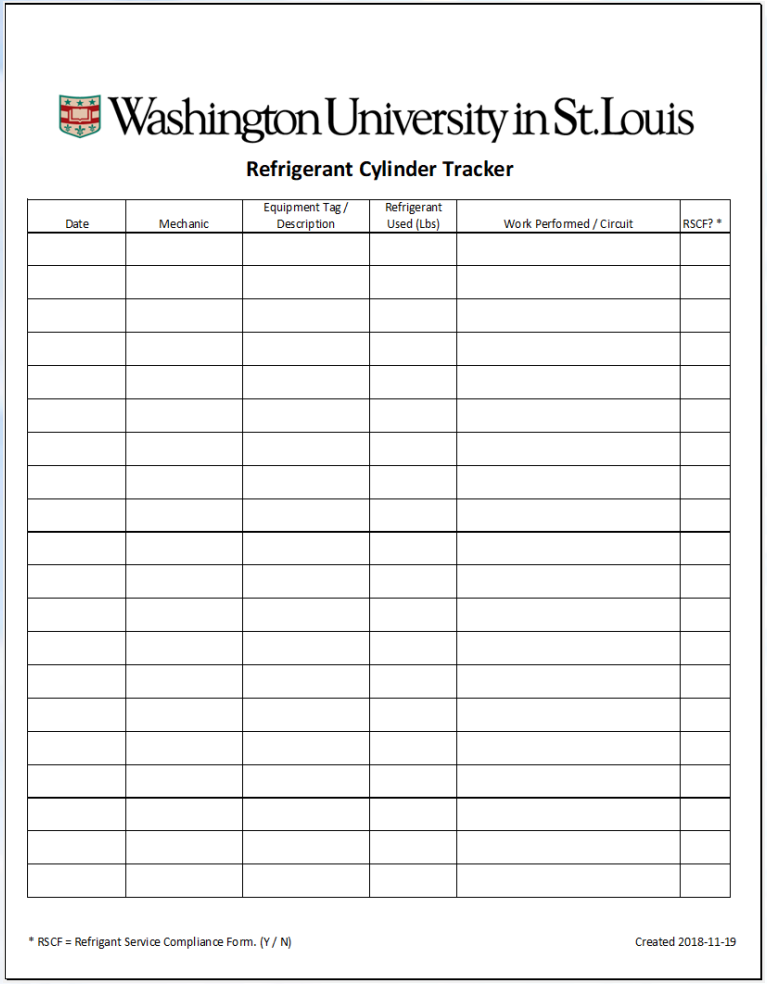
WU Policy - ZM's and Mechanics

- Refrigerant Cylinder Tracker
  - Track **ALL** Refrigerant Use
  - Track **ALL** recovered Refrigerant
  - Submit to obtain new cylinders



Washington University in St. Louis

Refrigerant Cylinder Tracker

Date	Mechanic	Equipment Tag / Description	Refrigerant Used (lbs)	Work Performed / Circuit	RSCF? *

* RSCF = Refrigant Service Compliance Form. (Y / N)

Created 2018-11-19

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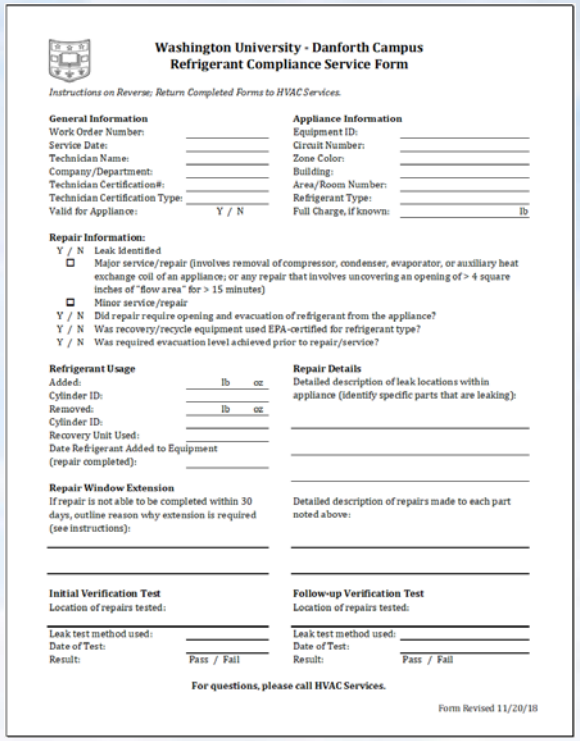
WU Policy - ZM's and Mechanics

- Refrigerant Service Compliance Form
  - Complete for ALL service on equipment circuits >50lbs.
  - If circuit size unknown, complete form



Washington University - Danforth Campus
Refrigerant Compliance Service Form

Instructions on Reverse; Return Completed Forms to HVAC Services.

General Information
Work Order Number:
Service Date:
Technician Name:
Company/Department:
Technician Certification#:
Technician Certification Type:
Valid for Appliance: Y / N

Appliance Information
Equipment ID:
Circuit Number:
Zone Color:
Building:
Area/Room Number:
Refrigerant Type:
Full Charge, if known: lb

Repair Information:
Y / N Leak Identified
☐ Major service/repair (involves removal of compressor, condenser, evaporator, or auxiliary heat exchange coil of an appliance; or any repair that involves uncovering an opening of > 4 square inches of "flow area" for > 15 minutes)
☐ Minor service/repair
Y / N Did repair require opening and evacuation of refrigerant from the appliance?
Y / N Was recovery/recycle equipment used EPA-certified for refrigerant type?
Y / N Was required evacuation level achieved prior to repair/service?

Refrigerant Usage
Added: lb oz
Cylinder ID:
Removed: lb oz
Cylinder ID:
Recovery Unit Used:
Date Refrigerant Added to Equipment (repair completed):

Repair Details
Detailed description of leak locations within appliance (identify specific parts that are leaking):

Repair Window Extension
If repair is not able to be completed within 30 days, outline reason why extension is required (see instructions):

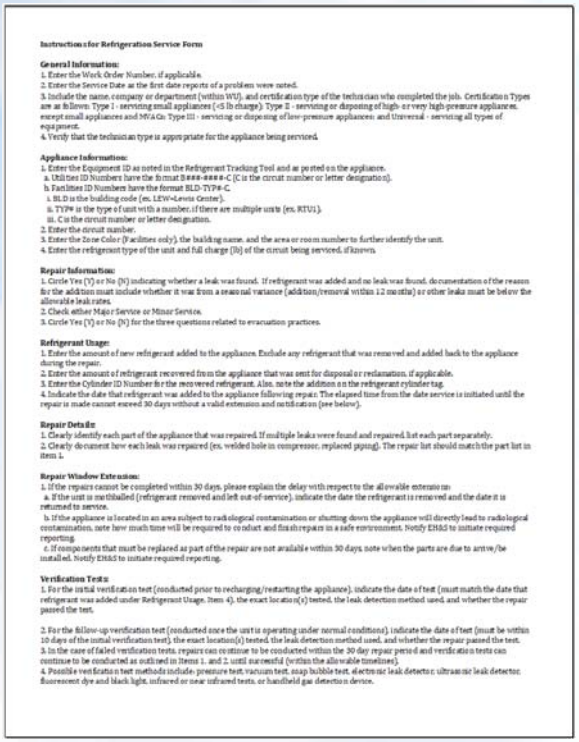
Detailed description of repairs made to each part noted above:

Initial Verification Test
Location of repairs tested:
Leak test method used:
Date of Test:
Result: Pass / Fail

Follow-up Verification Test
Location of repairs tested:
Leak test method used:
Date of Test:
Result: Pass / Fail

For questions, please call HVAC Services.

Form Revised 11/20/18



Instructions for Refrigeration Service Form

General Information:
1. Enter the Work Order Number, if applicable.
2. Enter the Service Date as the first date repairs of a problem were noted.
3. Include the name, company or department (within WU), and certification type of the technician who completed the job. Certification Types are as follows: Type I - servicing small appliances (<5 lb charge). Type II - servicing or disposing of high- or very high-pressure appliances, except small appliances and MVACs. Type III - servicing or disposing of low-pressure appliances; and Universal - servicing all types of equipment.
4. Verify that the technician type is appropriate for the appliance being serviced.

Appliance Information:
1. Enter the Equipment ID as noted in the Refrigerant Tracking Tool and as posted on the appliance.
   a. Utilities ID Numbers have the format B###-###-C (C is the circuit number or letter designation).
   b. Facilities ID Numbers have the format BLD-TYP#-C.
      i. BLD is the building code (ex. LEW=Lewis Center).
      ii. TYP# is the type of unit with a number, if there are multiple units (ex. RTU1).
      iii. C is the circuit number or letter designation.
2. Enter the circuit number.
3. Enter the Zone Color (Facilities only), the building name, and the area or room number to further identify the unit.
4. Enter the refrigerant type of the unit and full charge [lb] of the circuit being serviced, if known.

Repair Information:
1. Circle Yes (Y) or No (N) indicating whether a leak was found. If refrigerant was added and no leak was found, documentation of the reason for the addition must include whether it was from a seasonal variance (addition/removal within 12 months) or other leaks must be below the allowable leak rates.
2. Check either Major Service or Minor Service.
3. Circle Yes (Y) or No (N) for the three questions related to evacuation practices.

Refrigerant Usage:
1. Enter the amount of new refrigerant added to the appliance. Exclude any refrigerant that was removed and added back to the appliance during the repair.
2. Enter the amount of refrigerant recovered from the appliance that was sent for disposal or reclamation, if applicable.
3. Enter the Cylinder ID Number for the recovered refrigerant. Also, note the addition on the refrigerant cylinder tag.
4. Indicate the date that refrigerant was added to the appliance following repair. The elapsed time from the date service is initiated until the repair is made cannot exceed 30 days without a valid extension and notification (see below).

Repair Details:
1. Clearly identify each part of the appliance that was repaired. If multiple leaks were found and repaired, list each part separately.
2. Clearly document how each leak was repaired (ex. welded hole in compressor, replaced piping). The repair list should match the part list in item 1.

Repair Window Extension:
1. If the repairs cannot be completed within 30 days, please explain the delay with respect to the allowable extension in:
   a. If the unit is mothballed (refrigerant removed and left out-of-service), indicate the date the refrigerant is removed and the date it is returned to service.
   b. If the appliance is located in an area subject to radiological contamination or shutting down the appliance will directly lead to radiological contamination, note how much time will be required to conduct and finish repairs in a safe environment. Notify EH&S to initiate required reporting.
   c. If components that must be replaced as part of the repair are not available within 30 days, note when the parts are due to arrive/be installed. Notify EH&S to initiate required reporting.

Verification Tests:
1. For the initial verification test (conducted prior to recharging/restarting the appliance), indicate the date of test (must match the date that refrigerant was added under Refrigerant Usage, Item 4), the exact location(s) tested, the leak detection method used, and whether the repair passed the test.
2. For the follow-up verification test (conducted once the unit is operating under normal conditions), indicate the date of test (must be within 10 days of the initial verification test), the exact location(s) tested, the leak detection method used, and whether the repair passed the test.
3. In the case of failed verification tests, repairs can continue to be conducted within the 30 day repair period and verification tests can continue to be conducted as outlined in Items 1. and 2. until successful (within the allowable timelines).
4. Possible verification test methods include: pressure test, vacuum test, soap bubble test, electronic leak detector, ultrasonic leak detector, fluorescent dye and black light, infrared or near infrared tests, or handheld gas detection device.

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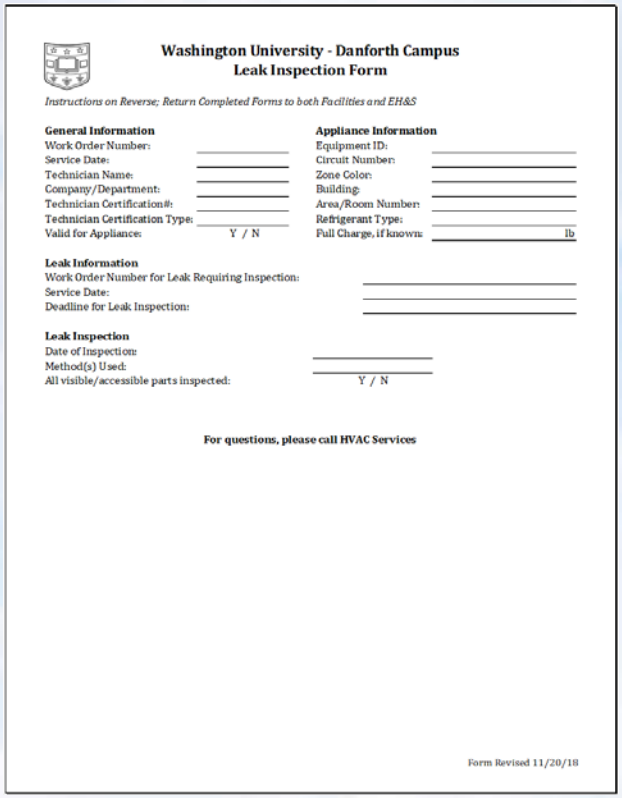
WU Policy - ZM's and Mechanics

- Leak Inspection Form
  - Complete when leak inspections required.



Washington University - Danforth Campus
Leak Inspection Form

Instructions on Reverse; Return Completed Forms to both Facilities and EH&S

General Information
Work Order Number: _____
Service Date: _____
Technician Name: _____
Company/Department: _____
Technician Certification#: _____
Technician Certification Type: _____
Valid for Appliance: Y / N

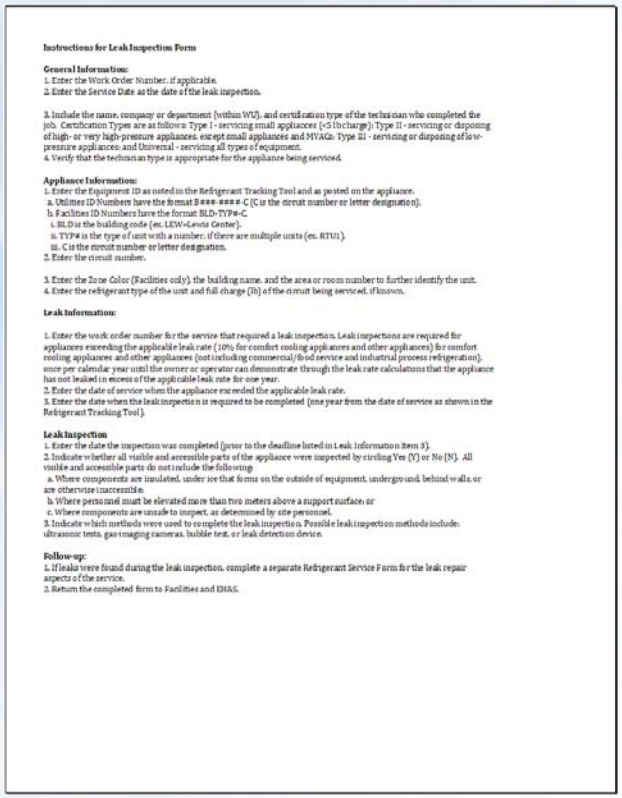
Appliance Information
Equipment ID: _____
Circuit Number: _____
Zone Color: _____
Building: _____
Area/Room Number: _____
Refrigerant Type: _____
Full Charge, if known: _____ lb

Leak Information
Work Order Number for Leak Requiring Inspection: _____
Service Date: _____
Deadline for Leak Inspection: _____

Leak Inspection
Date of Inspection: _____
Method(s) Used: _____
All visible/accessible parts inspected: Y / N

For questions, please call HVAC Services

Form Revised 11/20/18



Instructions for Leak Inspection Form

General Information:
1. Enter the Work Order Number, if applicable.
2. Enter the Service Date as the date of the leak inspection.

3. Include the name, company or department (within WU), and certification type of the technician who completed the job. Certification Types are as follows: Type I - servicing small appliances (<5 lb charge); Type II - servicing or disposing of high- or very high-pressure appliances, except small appliances and MVACs; Type III - servicing or disposing of low-pressure appliances; and Universal - servicing all types of equipment.
4. Verify that the technician type is appropriate for the appliance being serviced.

Appliance Information:
1. Enter the Equipment ID as noted in the Refrigerant Tracking Tool and as posted on the appliance.
   a. Utilities ID Numbers have the format S### ### # C (C is the circuit number or letter designation).
   b. Facilities ID Numbers have the format BLD-TYP#-C.
      i. BLD is the building code (ex. LEW=Lewis Center).
      ii. TYP# is the type of unit with a number, if there are multiple units (ex. RTU1).
      iii. C is the circuit number or letter designation.
2. Enter the circuit number.

3. Enter the Zone Color (Facilities only), the building name, and the area or room number to further identify the unit.
4. Enter the refrigerant type of the unit and full charge (lb) of the circuit being serviced, if known.

Leak Information:

1. Enter the work order number for the service that required a leak inspection. Leak inspections are required for appliances exceeding the applicable leak rate (10% for comfort cooling appliances and other appliances) for comfort cooling appliances and other appliances (not including commercial/food service and industrial process refrigeration), once per calendar year until the owner or operator can demonstrate through the leak rate calculations that the appliance has not leaked in excess of the applicable leak rate for one year.
2. Enter the date of service when the appliance exceeded the applicable leak rate.
3. Enter the date when the leak inspection is required to be completed (one year from the date of service as shown in the Refrigerant Tracking Tool).

Leak Inspection
1. Enter the date the inspection was completed (prior to the deadline listed in Leak Information Item 3).
2. Indicate whether all visible and accessible parts of the appliance were inspected by circling Yes (Y) or No (N). All visible and accessible parts do not include the following:
   a. Where components are insulated, under ice that forms on the outside of equipment, underground, behind walls, or are otherwise inaccessible;
   b. Where personnel must be elevated more than two meters above a support surface; or
   c. Where components are unsafe to inspect, as determined by site personnel.
3. Indicate which methods were used to complete the leak inspection. Possible leak inspection methods include: ultrasonic tests, gas imaging cameras, bubble test, or leak detection device.

Follow-up:
1. If leaks were found during the leak inspection, complete a separate Refrigerant Service Form for the leak repair aspects of the service.
2. Return the completed form to Facilities and EH&S.

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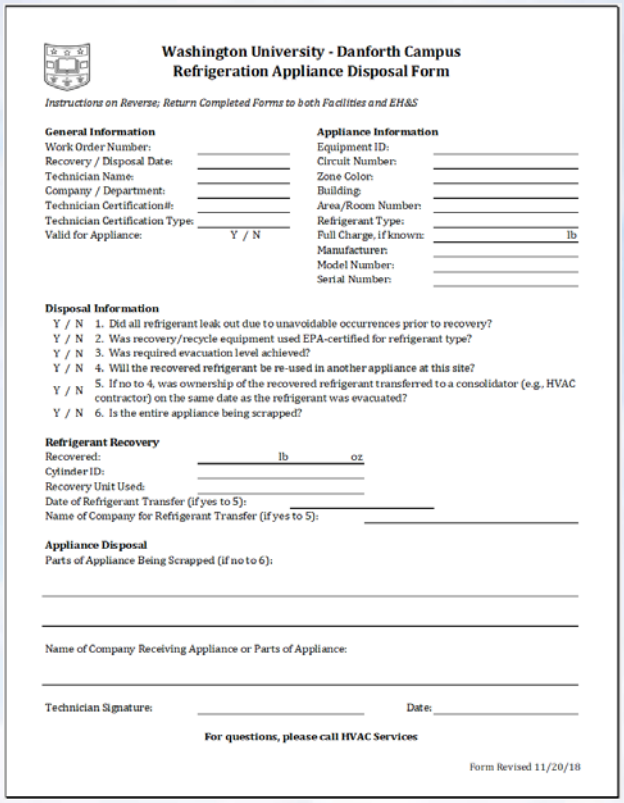
WU Policy - ZM's and Mechanics

- Disposal Form
  - Complete when appliances are disposed.



Washington University - Danforth Campus
Refrigeration Appliance Disposal Form

Instructions on Reverse; Return Completed Forms to both Facilities and EH&S

General Information

Work Order Number: _____
Recovery / Disposal Date: _____
Technician Name: _____
Company / Department: _____
Technician Certification#: _____
Technician Certification Type: _____
Valid for Appliance: Y / N

Appliance Information

Equipment ID: _____
Circuit Number: _____
Zone Color: _____
Building: _____
Area/Room Number: _____
Refrigerant Type: _____
Full Charge, if known: _____ lb
Manufacturer: _____
Model Number: _____
Serial Number: _____

Disposal Information

Y / N 1. Did all refrigerant leak out due to unavoidable occurrences prior to recovery?
Y / N 2. Was recovery/recycle equipment used EPA-certified for refrigerant type?
Y / N 3. Was required evacuation level achieved?
Y / N 4. Will the recovered refrigerant be re-used in another appliance at this site?
Y / N 5. If no to 4, was ownership of the recovered refrigerant transferred to a consolidator (e.g., HVAC contractor) on the same date as the refrigerant was evacuated?
Y / N 6. Is the entire appliance being scrapped?

Refrigerant Recovery

Recovered: _____ lb _____ oz
Cylinder ID: _____
Recovery Unit Used: _____
Date of Refrigerant Transfer (if yes to 5): _____
Name of Company for Refrigerant Transfer (if yes to 5): _____

Appliance Disposal

Parts of Appliance Being Scrapped (if no to 6):

_____

_____

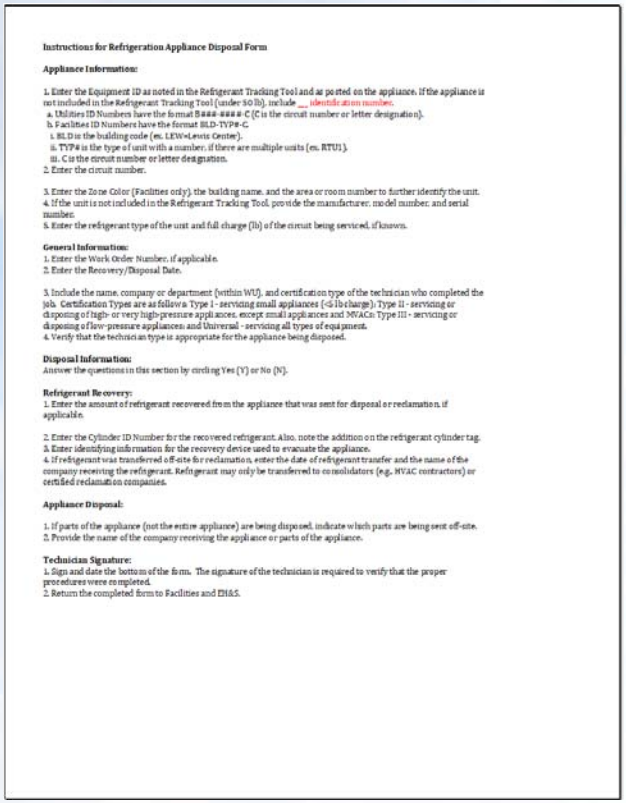
Name of Company Receiving Appliance or Parts of Appliance:

_____

Technician Signature: _____ Date: _____

For questions, please call HVAC Services

Form Revised 11/20/18



Instructions for Refrigeration Appliance Disposal Form

Appliance Information:

1. Enter the Equipment ID as noted in the Refrigerant Tracking Tool and as posted on the appliance. If the appliance is not included in the Refrigerant Tracking Tool (under 50 lb), include ___ identification number.
   a. Utilities ID Numbers have the format B###-###-C (C is the circuit number or letter designation).
   b. Facilities ID Numbers have the format BLD-TYP#-C.
      i. BLD is the building code (ex. LEW=Lewis Center).
      ii. TYP# is the type of unit with a number, if there are multiple units (ex. RTU1).
      iii. C is the circuit number or letter designation.
2. Enter the circuit number.

3. Enter the Zone Color (Facilities only), the building name, and the area or room number to further identify the unit.
4. If the unit is not included in the Refrigerant Tracking Tool, provide the manufacturer, model number, and serial number.
5. Enter the refrigerant type of the unit and full charge (lb) of the circuit being serviced, if known.

General Information:

1. Enter the Work Order Number, if applicable.
2. Enter the Recovery/Disposal Date.

3. Include the name, company or department (within WU), and certification type of the technician who completed the job. Certification Types are as follows: Type I - servicing small appliances (<5 lb charge); Type II - servicing or disposing of high- or very high-pressure appliances, except small appliances and MVACs; Type III - servicing or disposing of low-pressure appliances; and Universal - servicing all types of equipment.
4. Verify that the technician type is appropriate for the appliance being disposed.

Disposal Information:

Answer the questions in this section by circling Yes (Y) or No (N).

Refrigerant Recovery:

1. Enter the amount of refrigerant recovered from the appliance that was sent for disposal or reclamation, if applicable.

2. Enter the Cylinder ID Number for the recovered refrigerant. Also, note the addition on the refrigerant cylinder tag.
3. Enter identifying information for the recovery device used to evacuate the appliance.
4. If refrigerant was transferred off-site for reclamation, enter the date of refrigerant transfer and the name of the company receiving the refrigerant. Refrigerant may only be transferred to consolidators (e.g., HVAC contractors) or certified reclamation companies.

Appliance Disposal:

1. If parts of the appliance (not the entire appliance) are being disposed, indicate which parts are being sent off-site.
2. Provide the name of the company receiving the appliance or parts of the appliance.

Technician Signature:

1. Sign and date the bottom of the form. The signature of the technician is required to verify that the proper procedures were completed.
2. Return the completed form to Facilities and EH&S.

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WU Policy - ZM's and Mechanics

- Vendors
  - Refrigerant Service Compliance Form required for **ALL** vendor work
  - Obtain EPA Refrigerant Certification from vendor personnel. Submit with Refrigerant Service Compliance Form. When in doubt, get the certification

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WU Policy - ZM's and Mechanics

- Leak Repair Provisions
  - Determine next steps with HVAC Services and EH&S
  - Zone Managers / Mechanics responsible for performing all leak repair provisions
  - Submit documentation to HVAC Services

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WU Policy - ZM's and Mechanics

- Mechanics
  - Mechanics responsible for following all EPA regulations
  - Maintain equipment in good working order

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WU Policy – Capital Projects

- Complete Refrigerant Service Compliance Form for **ALL** work on refrigerant containing equipment > 50lbs
- Complete Refrigerant Service Compliance Form for **ALL** equipment disposals
- Notify HVAC Services of new equipment with >50 lbs of refrigerant

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WU Policy - Utilities

- See procedures for Zone Mangers and Mechanics

- Utilities may enter data directly into refrigerant database

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WU Policy – HVAC Services

- Maintaining Database
  - Refrigerant Service Compliance Form
  - EPA Certifications
  - Refrigerant Cylinder Trackers
- Notify when EPA thresholds are exceeded
- Coordinate with EH&S regarding EPA correspondence

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WU Policy – HVAC Services

- **Not** responsible for ensuring accuracy of data
  - Garbage In = Garbage Out

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WU Policy – EH&S

- All correspondence with EPA

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WU Policy - Scope

- Facilities Equipment ONLY
  - Exception = disposal for departments
- Facilities not tracking
  - Kitchen Equipment
  - Laboratory Equipment
  - Ultra-Low Temperature Freezers

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Questions?

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EQ article provided at:
https://www.trinityconsultants.com/news/federal/refrigerant-rule-revisions--is-your-facility-prepared
Complete summary table in PDF format provided at:
http://www.trinityconsultants.com/Documents/Summary-of-Key-Revisions-to-Refrigerant-Management-

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Changes to Subpart F Sections

Old Rule

- 82.152 - Definitions
- 82.154 – Prohibitions
- 82.156 – Required practices; (i) includes leak repair provisions
- 82.158 – Standards for recycling & recovery equipment
- 82.160 – Approved equipment testing organizations
- 82.161 – Technician certification
- 82.162 – Certification by owners of recovery & recycling equipment
- 82.164 – Reclaimer certification
- 82.166 – Reporting & recordkeeping requirements

Blue = new
Red = revised
Green = deleted

New Rule

- 82.152 - same
- 82.154 – same
- 82.155 – Safe disposal of appliances
- 82.156 – Proper evacuation of refrigerant from appliances; (i) applies until 1/1/2019
- 82.157 – Appliance maintenance & leak repair (applies staring 1/1/2019)
- 82.158 – Standards for recovery and/or recycling equipment
- 82.160 - same
- 82.161 – same
- 82.162 – deleted
- 82.164 - same
- 82.166 – Reporting & recordkeeping requirements for leak repair (until 1/1/2019)

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Summary of Changes by Effective Date (1 of 3)

Effective Date	Rule Provision/Citation
01/01/2017	Sales restriction on used non-exempt substitutes, 82.154(d)
01/01/2017	Sales restriction on appliances with non-exempt substitutes (servicing aperture/process stub), 82.154(e)
01/01/2017	Certification of new manufactured/imported recovery/recycling equipment for use with non-exempt substitutes, 82.158
01/01/2017	Non-exempt substitute reclaimer certification, 82.164
01/01/2017	Elimination of one-time notification of acquisition of certified recovery/recycling equipment, 82.162 of old rule
01/01/2017	New definition of *comfort cooling*, 82.152
01/01/2017	Modified definition of *disposal* to cover vandalism and intentional cutting of refrigerant lines, 82.152
01/01/2017	Approved equipment testing organizations must publish online list of certified recovery/recycling equipment, 82.160(e)(1)

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Summary of Changes by Effective Date (2 of 3)

Effective Date	Rule Provision/Citation
01/01/2017	Signed statement requirement in event all ODS-containing refrigerant leaked out prior to delivery of small appliances, MVACs, and MVAC-like appliances for disposal, 82.155
01/01/2018	Signed statement requirement in event all non-exempt substitutes leaked out prior to delivery of small appliances, MVACs, and MVAC-like appliances for disposal, 82.155
01/01/2018	Sales restriction on new non-exempt substitutes, 82.154(c)(1)
01/01/2018	Small (≤ 2 lb) cans of non-exempt substitutes for MVACs must be equipped with self-sealing valves, 82.154(c)(2)
01/01/2018	Technicians must be certified to maintain, service, repair, or dispose* of appliances containing non-exempt substitutes, 82.161(a)
01/01/2018	Approved technician certification programs must publish online list of technicians they have certified on or after 01/01/2017, 82.161(b)(6)

*Consistent with previous rule, technicians do not have to be certified to dispose of small appliances, MVACs, and MVAC-like appliances.

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Summary of Changes by Effective Date (3 of 3)

Effective Date	Rule Provision/Citation
01/01/2018	Evacuation requirements for disposal and/or opening of appliances containing non-exempt substitutes, 82.155 & 82.156(a)-(d)
01/01/2018	Recordkeeping requirements for disposal of appliances with full charge > 5 lbs and < 50 lbs, 82.156(a)(3)
01/01/2019	Revised leak rate provisions for appliances with full charge ≥ 50 lbs refrigerant, 82.157

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