OPERATIONS DIVISION
STANDARD OPERATING PROCEDURE

OD/SOP 08.08 Utilities Refrigerant Management

DATE: April 22, 2016

PURPOSE

The purpose of this Operations Division/Standing Operating Procedure (OD/SOP) is to set forth a strategic approach and general guidance for managing all aspects of refrigerant handling within Utilities. This procedure is to efficiently use, recover, recycle, and reclaim refrigerants and safely handle, store, and dispose of them. A direct and coordinated management approach is required in order to support the objectives of the Clean Air Act of 1990. This includes protecting the earth's upper ozone level and reducing global warming. Utilities will provide a safe, healthy, and comfortable workplace for the employees occupying the central plants while ensuring compliance with local, state, and federal laws, rules, and regulations.

REVIEW

This OD/SOP will be reviewed bi-annually by the Utilities Manager and Superintendent for Operations and recommendations forwarded to the Director for Utilities.

STANDARD OPERATING PROCEDURE

1. Mission Statement

   "It shall be the mission of the area of Utilities to contain all refrigerants and prevent the substances from entering the environment. All refrigerants shall be recovered, recycled, or reclaimed using proper refrigeration service techniques."

2. Definitions

   a. Appliance: Any device which contains and uses a Class I (CFC) or Class II (HCFC) substance as a refrigerant and which is used for household or commercial purposes, including any air conditioner, refrigerator, chiller, or freezer.

   b. De Minimus: The minimum amount of refrigerant released during good faith attempts to recover refrigerant.

   c. Major Leak: A leak that exceeds 15 (fifteen) percent annual loss as per section 8. (3) (d) [4] of this OD/SOP.

   d. Major Repair: Maintenance, service, or repair that involves the removal of the

appliance compressor, condenser, evaporator, or auxiliary heat exchanger coil.

e. Minor Leak: A leak rate that does not exceed 15 (fifteen) percent each year as stated in Section 8. (3) (d) [4] of this OD/SOP.

f. Opening An Appliance: Any service, maintenance, or repair of an appliance that could reasonably be expected to release refrigerant from the appliance into the atmosphere, unless the refrigerant was previously recovered from the appliance.

g. Ozone Depletion Potential: Rating of a chemical's ability to destroy ozone.

h. Reclaim: To reprocess refrigerant to at least the purity specified in ARI Standard 700-1988, *Specifications for Fluorocarbon Refrigerants*, and to verify this purity as prescribed in the standard. The main difference between "recycle" and "reclaim" is that "recycle" does not involve a chemical analysis of the product. This chemical analysis is only available at a reprocessing or manufacturing facility.

i. Recover: To remove refrigerant in any condition from an appliance without necessarily testing or processing it in any way.

j. Recovery Equipment: Two types:

(1) Self-contained (active): Self-contained equipment has its own means to draw refrigerant from a refrigeration system, and

(2) System dependent (passive): System-dependent equipment relies solely upon the compressor in the appliance or the pressure of the refrigerant in the appliance to recover the refrigerant.

k. Recycle: To extract refrigerant from an appliance and clean it for reuse without meeting all of the requirements for reclamation. Recycled refrigerant is refrigerant cleaned using oil separation, which reduces moisture, acidity, and/or filtration to remove particulate matter. This is performed on-site.

l. Technician: Any person who performs maintenance, service, or repair who could reasonably be expected to release Class I or Class II substances from appliances into the atmosphere, including but not limited to installers, contract employees, in-house service personnel, and in some cases, owners.

m. Venting: Releasing ozone-depleting chemicals into the atmosphere.

3. Facility Refrigerant Manager Designation

a. The Utilities Manager is designated as the Facility Refrigerant Manager for the department and shall be responsible for all refrigerant management. Principal duties (with assistance from the Projects and Training Coordinator) will include but not limited to:

(1) Maintain records of purchases, maintenance, and record keeping of refrigerant inventories and usage.

(2) Remaining current on refrigeration technologies. Gathering and disseminating information on refrigerant technology, codes, and regulations.

(3) Overseeing the training and certification of technicians.

(4) Developing and implementing a Refrigerant Management Instructions.

(5) Ensuring the compliance with all rules and regulations.

(6) Mitigating risks associated with refrigerant issues.

b. The plant superintendents will be responsible for:

(1) Planning for future needs for refrigerants and equipment.

(2) Ensuring the safety of personnel in contact with refrigerants.

4. <u>No Vent Law</u>

a. Requirements

(1) Effective July 1, 1992, it became unlawful for any person, in the course of maintaining, servicing, repairing, or disposing of an appliance or industrial process refrigeration, to knowingly release or dispose of any Class I or Class II substances used as a refrigerant in such appliances in a manner which permits such substances to enter the environment.

(2) Effective November 15, 1995, it became unlawful to intentionally vent alternative refrigerants (R-134a, R-406a, etc.).

b. Exceptions

(1) “De minimus” or minimum amounts during “good faith” attempts to recover refrigerant.

(2) Emitted during normal operation (purge unit).

(3) Mixtures of nitrogen and R-22 that are used as holding charges or as leak test gases.

5. Enforcement

Under the Clean Air Act of 1990, the EPA is authorized to assess fines of up to $27,500 per day per any violation of the Act. EPA may pay a reward not to exceed $10,000 to any person who furnishes information or services that lead to a criminal conviction or civil penalty assessed as a result of violation of the Act. If the EPA comes into possession of information indicating that a member of the department may have knowingly vented Class I or Class II substance in violation of Section 608 (c) (1) of the Clean Air Act, the EPA is authorized to request records and such other information that they may reasonably require for the purposes of determining whether such person(s) is (are) in violation of any provision of the Act.

6. Record Keeping

The establishment and maintenance of good record keeping procedures is very helpful and is one of the best methods of checking the performance of an operating system. Records must be maintained for a period of three (3) years unless otherwise specified.

a. Technicians

(1) After November 14, 1994, all technicians will be required to maintain a copy of their technician certification card in their employee file.

(2) Technicians who service systems which normally contain a refrigerant charge of 50 (fifty) pounds or more are required to provide the owner of the equipment with an invoice or other documentation that indicates the amount of refrigerant added to the system (work order/ refrigerant log).

b. Responsibilities

(1) Operations / Maintenance Foreman: Is responsible for initiating a work order anytime an activity involves handling or transferring of refrigerant.

(2) Utilities Manager: Is responsible for auditing all refrigerant transfer logs on a regular basis, identifying discrepancies, and reporting results to the Director for Utilities.

(3) Utilities Personnel: Every member of the Utilities section is responsible for documenting all maintenance evolutions regarding refrigerants. They will enter enough detailed information on the repair work order, PM work

order, or project work order to have an accurate historical account of the evolution. They will also record all refrigerant transfers and audit information in the department's refrigerant transfer log for the appropriate piece of equipment.

c. Owners of Recovery Units: Owners of recovery and recycling units must certify to their EPA regional office that they own and are properly using recovery equipment in compliance with all rules and regulations.

d. Owners of Appliances: Owners of large systems with a refrigerant charge of 50 or more pounds will maintain the following records:

(1) Diagnosis of problems and remedial actions taken.

(2) The quantities of refrigerant purchased and sent to a reclamation facility.

(3) Date and amount of refrigerant charged to the system.

(4) Any repair or service procedures performed on the equipment.

(5) Any changes in system operation or performance.

(6) Changes in level indicator readings that do not correspond to load changes.

7. Technician Certification and Agreement

All employees are required to become certified through an EPA-approved technician certification program within six (6) months of employment. The sale of Class I and Class II refrigerants will be restricted to certified technicians. In Utilities, technicians must be certified as a Universal technician. The University will provide all training, but failure to pass the EPA examination after three (3) attempts will result in the employee paying all expenses to include travel, materials, and fees for any additional testing or be terminated. These certifications are as follows:

a. Type I: Small appliances with less than five (5) pounds of refrigerant and charged at the factory.

b. Type II: Systems that use 5 pounds or more of high-pressure refrigerants (i.e., R12, R134A).

c. Type III: Systems that use low-pressure refrigerants (i.e., R11, R123)

d. Universal: Allows technician to work on all system types.

8. Recovery Equipment

Utilities will ensure that refrigerant used in refrigeration and air conditioning systems are recovered and/or recycled for reuse, reprocessed (reclaimed), or properly disposed of whenever removed from the system. The Utilities personnel will use good faith efforts to minimize the loss of any refrigerant into the atmosphere.

a. Owners of Recovery and Recycling Equipment

As owners of recycling and recovery equipment, extra care will be taken to properly maintain all service equipment used to support refrigeration and air conditioning work. This section will possess sufficient certified recovery and recycling equipment including grandfathered equipment to perform on-site recycling and recovery.

Utilities will ensure compliance with EPA regulations by submitting a statement containing the required information. This information will include:

(1) Name of the manufacturer,

(2) Date of purchase,

(3) Date equipment was manufactured, and

(4) Model number and serial number.

This statement will be sent to the regional EPA office within 20 (twenty) days of commencing business for existing equipment and within 30 (thirty) days of new purchases.

b. System Evacuation Levels

In order to comply with the regulations effective July 13, 1993, technicians must evacuate the refrigerant in the entire unit to a certified recovery or recycling machine when removing refrigerant from all appliances except small ones. Applicable evacuation levels specified below shall be met. This requirement applies to appliances containing CFC, HCFC, the alternate refrigerants for both, and isolated components of such appliances.

Appliance	Recovery Unit Manufactured **BEFORE** Nov. 14, 1993	Recovery Unit Manufactured **AFTER** Nov. 14, 1993
	Inches of Hg	Inches of Hg
HCFC-22 appliance with < 200 lb. Charge	0	0
HCFC-22 appliance with >200 lb. Charge	4	10
Other high pressure appliance with <200 lb. charge	4	10
Other high pressure appliance with >200 lb. charge	4	15
Very high pressure equipment	0	0
Low pressure equipment	25	29 (25mm Hg Abs)

c. Exceptions to Evacuation Level Requirements

The regulation permits exceptions to achieving the evacuation levels as indicated in the table above: when the repairs to the system are not major and if system leaks prevent achieving required evacuation levels without contaminating the refrigerant being recovered. The requirements for using these exceptions are as follows:

(1) Non-major repairs: If the service to be performed on the system is not major, defined by EPA as the removal of major system components, and if the system is not evacuated to the atmosphere after completion of servicing, then the pressure in the system or component being serviced may be reduced to atmospheric pressure. If the service being performed requires subsequent evacuation of the system or component using a deep vacuum pump, then required evacuation levels must be achieved. For low-pressure systems this exception applies if the pressure in the system or component to be serviced may be raised using a method that does not require subsequent purging. The use of nitrogen or other gases to raise the pressure is prohibited. Controlling the temperature of the refrigerant is the only viable method for raising pressure and complying with the regulation.

(2) System leaks: If system leaks prevent reaching the required level of evacuation without contaminating the recovered refrigerant, the technician is permitted to evacuate the system to the lowest achievable level. In no instance shall this pressure exceed atmospheric. Once the determination has been made that system leaks will prevent evacuation to the prescribed levels, regulations require the technician to perform the following procedures:

(a) Isolate leaking from non-leaking components wherever possible.

(b) Evacuate non-leaking components to mandated level.

(c) Evacuate leaking components to the lowest achievable level.

(3) Required system leak repairs: As owners of comfort cooling equipment, it is the department's responsibility to determine if owned equipment leaks substantial amounts of refrigerant. For equipment containing 50 (fifty) pounds or more and to comply with EPA regulations, detected leaks greater than 15 (fifteen) percent per year shall be fixed within 30 (thirty) days or equipment must be retrofitted or replaced within one year.

Leak repair requirements apply to comfort cooling equipment. The requirements are based on the annual rate of release of refrigerant from recovered equipment. Equipment exceeding specified annual leak rates must be repaired within certain time limits. Action deadlines include:

(a) Fix all leaks greater than 15 (fifteen) percent per year within 30 (thirty) days of discovery or within 30 (thirty) days of when the leak(s) should have been discovered; or

(b) Write a one-year retrofit or retirement plan for the leaking equipment and have it on file at the equipment site within 30 (thirty) days.

(c) Computing Leak Rate - The trigger for repair requirements is the current Leak Rate rather than the total quantity of refrigerant lost. The Leak Rate is computed as follows:

$$\frac{\text{Refrigerant Charged into Equip.}}{\text{Total Normal Charge}} \times \frac{365 \text{ day/year}}{\text{\# of Days since Last Charge}} = \textbf{Leak Rate}$$

The technician will charge the equipment and record the amount of refrigeration charged into the equipment. The computation also requires the normal charge for the equipment and the number of days since the last time the equipment was brought up to normal charge.

(d) Leak Testing Positive Pressure Equipment: The following guidelines

will be used for leak testing positive pressure refrigeration equipment:

[1] All leak testing will be performed using an electronic leak detector, soap bubble test, standing vacuum test, fluorescent dyes, or ultrasonic detector.

[2] If the unit still contains refrigerant with adequate pressure, secure system and check for leaks starting at the top of the unit and work downward. Be aware of signs of oil, as it is a good indication that a leak is nearby.

[3] If the leak cannot be found, the refrigerant charge will be recovered from the equipment. The vacuum level reached during recovery is left to the discretion of the foreman as trying to reach recommended levels may introduce non-condensables into the system.

[4] When all the refrigerant has been recovered or if the unit was totally out of refrigerant from the start, a leak check will be performed using dry nitrogen and a trace of R-22.

[5] Pressurize the unit to 125 psi for high-pressure equipment and 10 psi for low-pressure equipment. Systematically leak-check any possible place where refrigerant could escape. Do not limit yourself to only that portion of the system that is soldered or brazed.

[6] If no leak is found, an increase in test pressure will be required. Verify the setting of the safety relief valve before you increase the pressure. Do not exceed the setting of the safety relief valve. Do not exceed 10 (ten) psi on low-pressure equipment.

[7] If a leak is still not found, put the system back into operation and add fluorescent dye to the system. Documentation is a must.

[8] After the unit has been back in service for 8 (eight) hours, return with a black light and leak-check the system.

[9] Upon finding a leak, recover the charge and make the repair.

[10] Perform a leak test using dry nitrogen and a trace of R-22.

[11] Ensure that all leaks are fixed.

[12] Evacuate the system, charge and check operation.

(4) Refrigerant Recovery Procedure

(a) All recovery tanks are to be labeled with the type of refrigerant that it contains.

(b) Each piece of recovery equipment shall be leak-tested quarterly. All units must meet EPA mandated evacuation levels.

(c) Start the recovery procedure.

(d) If using a recovery tank that already contains refrigerant, one of two conditions be met:

[1] Refrigerant that exists in the tank must come from the equipment of the same owner, same refrigerant type, and tested as acceptable for reuse.

[2] Refrigerant that exists in the tank must be of the same type as that being recovered and not intended for re-use. At no time is it acceptable to mix different refrigerants in the same recovery tank.

(e) Align the system for refrigerant recovery as per the Operator's Manual.

(f) Use digital scale to record amounts of refrigerant recovered.

(g) Begin the recovery process. Whenever possible recover liquid refrigerant first. This is the fastest recovery method.

(h) If unable to recover in the liquid mode, monitor the recovery process until all liquid is recovered, then change to the vapor recovery mode. At all times monitor the weight of refrigerant in the recovery unit.

(i) Ensure that EPA mandated vacuum levels are reached.

(j) After reaching the required vacuum level, isolate the equipment, turn off the recovery equipment, and watch the gauges. An increase in pressure may indicate additional refrigerant in the equipment system, necessitating additional recovery.

(k) When recovery is complete, secure all equipment and proceed with repairs.

9. Equipment Labeling and Storage

a. Labeling

(1) EPA requires that each piece of certified recycling and recovery equipment be properly labeled. This label shall state:

This equipment has been certified by ARI/UL to meet EPA's minimum requirements for recycling or recovery equipment intended for use with High Pressure or Low Pressure Refrigerant (whichever is applicable).

(2) The label must show the manufacture date and, if applicable, the equipment's serial number. The label shall be:

(a) readily visible and accessible;

(b) made from a material expected to last and remain legible through the equipment's lifetime; and

(c) be affixed so that it cannot be removed from the equipment without damage to the label.

b. Storage

Storage of Ozone Depleting Compounds (ODCs) must be in compliance with all NFPA codes and standards. NFPA allows the equivalent of up to one (1) full charge to be stored in the same mechanical room as the chiller.

10. Handling of Refrigerant On-Site

No refrigerant cylinder will ever be filled in excess of 80 (eighty) percent of fluid capacity. The hydrostatic pressure created by overfilling containers poses a serious safety violation. This condition can result in an explosion of impressive magnitude causing serious damage to both personnel and property.

11. Refrigerant Contamination

Refrigerant shall not be mixed. A separate, clean, and evacuated recovery vessel for each refrigerant shall be provided. Reclamation centers will not accept mixed refrigerants and the department will be charged for disposal of the mixed refrigerants. It is imperative that each cylinder be labeled and marked in accordance with ARI Guidelines K and N, and EPA requirements.

12. Disposal Processes

Equipment that typically is dismantled on site before disposal must have the refrigerant removed in compliance with the EPA's servicing requirements. The final person in the disposal chain of command is responsible for ensuring that refrigerant is recovered from the equipment before disposal. Any technician who takes the final step in the process of disposing of refrigerant equipment must recover refrigerant to specified evacuation levels. The following information must be recorded:

a. Name of the person recovering the refrigerant,

b. Date refrigerant was recovered,

c. Amount of refrigerant recovered, and

d. Evacuation level achieved.

13. Refrigerant Safety

Utilities has recovery and recycling equipment available for each service technician as a means of recovering or recycling refrigerants. It shall be the responsibility of each service technician to maintain each machine in good working order. If for any reason the machine does not function properly the service technician will be required to notify supervisors in order to replace the non-functioning recovery device with one that functions before proceeding with the service.

14. Disposal of Refrigerant Oil

Oils that are extracted from refrigerant, recovery machines, or vacuum pumps will be disposed of with the Environmental Health and Safety for disposal as hazardous waste.

RESPONSIBILITIES

POSITION	SECTION	MONTH	DAY
Superintendent for Operations	Review	April (ENY)	1
Utilities Manager	Review		

Approved: Dale K Bennett — Digitally signed by Dale K Bennett, DN: cn=Dale K Bennett, o, ou, email=dale.bennett@ttu.edu, c=US, Date: 2016.04.22 14:08:08 -05'00'
Utilities Manager

Approved: Garry Don Moore — Digitally signed by Garry Don Moore, DN: cn=Garry Don Moore, o, ou=TTU Operations Utilities, email=Garry.moore@ttu.edu, c=US, Date: 2016.04.25 08:58:40 -05'00'
Operations Superintendent

Approved: Dale Townsley — Digitally signed by Dale Townsley, DN: cn=Dale Townsley, o=Utilities, ou=Operations, email=dale.townsley@ttu.edu, c=US, Date: 2016.04.26 13:56:58 -05'00'
Director of Utilities