How familiar are you with your building's mechanical equipment room? These areas are often "out of sight, out of mind" for building owners and managers. But operational and safety guidelines for mechanical rooms are spelled out in industry standards that you, as a professional, are liable to comply with just by being aware of them. And since these standards are commonly used to draft municipal building codes, they may also be the law in your locale.

Your Mechanical Room and ASHRAE 15-1994: 2001 Update

The standard is intentionally written in code language so it can be adopted nearly verbatim by model code associations — and it can be difficult to understand.

Your Liability
When must you comply with ASHRAE 15-1994?

Check It Out
Safety checklist for your mechanical room

Compliance
What steps should you take to comply with ASHRAE 15-1994?

Refrigerants
Understanding their properties

Your Liability
When must you comply with ASHRAE 15-1994?

A Standard For Mechanical Room Safety

ASHRAE Standard 15 was first issued as a safety code in 1930, the same year that CFC (chlorofluorocarbon) refrigerants were introduced in the United States. With increasing refrigerant regulations and phaseouts, as well as the development of alternative refrigerants, the standard has undergone unusually rapid change over the last decade. It was revised in 1992 and again in 1994, followed by several addenda in the late 1990s.

The primary goal of the standard is to mitigate risks to the environment, to mechanical room operators and, ultimately, to the general public. Since refrigerants have varying degrees of toxicity and flammability, specific procedures and training are needed to use them safely.

ASHRAE 15-1994: Your Liability

Even if your local codes haven’t yet been updated to reflect ASHRAE 15-1994, compliance with the standard can minimize your legal liability by demonstrating that you have gone to the furthest extent possible to promote mechanical room safety. And, as previously noted, as a building professional or owner, you are considered liable for compliance if you are aware of the standard. ASHRAE 15 typically applies in several ways.

Mechanical Room Changes

The CFC and HCFC (hydrochlorofluorocarbons, i.e. R-123, R-22) refrigerant production phaseout has raised the critical issue of what to do with existing chillers. There are pros and cons to each possible solution — containment, conversion or replacement — and therefore, a thorough evaluation is necessary. It is particularly important to understand that if the type of refrigerant in a chiller is changed or if the chiller itself is replaced, ASHRAE 15-1994 applies. Section 5.3 of the standard reads: “A change in the type of refrigerant in a system shall not be made without the notification of the authority having jurisdiction, the user and due observance of safety requirements. The refrigerant being considered shall be evaluated for suitability.” (The addition of containment devices, such as high efficiency purges and back-up relief valves to your existing equipment, however, does not trigger application of the standard.)

Upgrading a mechanical room to meet the standard typically adds 11 to 13% to the total chiller conversion/replacement project cost, depending on the room’s age and location. This expense should be factored into your refrigerant planning cost analysis.

Your local building codes may have already been rewritten to reflect ASHRAE 15-1994.

Whether you’re evaluating an existing mechanical room or assessing the situation before acquiring a building, a comprehensive safety check is a must. Here’s a checklist of some key potential trouble spots, as illustrated in Figure 1.

1. Are there low areas in the mechanical room?
   Check the condition of pits or other areas below floor level. They may hold chemical residues such as acids, spilled refrigerant, cleaning solvents, etc.

2. Where does the purge vent?
   A conventional purge (not high efficiency) loses up to 20 pounds of refrigerant for every pound of non-condensable air it removes from the system. All purges should vent outside. If high efficiency purges are used, they should be specified per the new ARI (American Refrigeration Institute) Standard 580-2000. Some new high efficiency purges have been vented to relief disk pipes. This is not a good practice as refrigerant may condense to the thin rupture disk resulting in failure due to corrosion.

3. Where are safety rupture disk outlets located?
   Thin carbon rupture disks are often vented through the roof or side wall. Locations should be at least 15 feet above ground level.

4. Could roof drains collect refrigerant?
   If you lose refrigerant from an exhaust outlet and it vents above a flat, curbed roof, the refrigerant could lay across the roof and find the first exit — probably down the roof drains and into a sewer system.

5. Are exhaust outlets near inlet vents?
   Chiller safety relief devices typically vent outdoors, usually through the roof. Check the vent’s proximity to air intakes — they should be at least 20 feet apart.

6. Is access to the mechanical room restricted?
   These potentially hazardous spaces contain systems critical to a building’s operation. The mechanical room door should have a tight seal to isolate the room in an emergency, as well as prominent signage limiting access to trained personnel only.

7. Where do the floor drains empty?
   If your chiller and occupied space share the same floor, they may also share a drainage system. Check to see if drains in the occupied space (i.e., in restrooms) are connected to those in the mechanical room. Imagine losing a full charge and “finding” it in a restroom!

8. Are rupture lines the right size and length?
   For convenience, safety devices will run into a common header if they have common refrigerants. Chillers with different refrigerants should never share common headers. An improperly sized header can exacerbate problems in an emergency, when the discharge capacity of safetylines is put to the test.

9. Are chiller drain valves secured?
   These valves are an easy way for an inexperienced technician to get into trouble. Make sure the valves are locked off.
Building Code Compliance

Your local building codes may already have been rewritten to reflect ASHRAE 15-1994. Many of the major U.S. building code jurisdictions have incorporated the standard into their model codes, and state and municipal authorities are following suit.

To find out what's happening with codes in your area, meet with your local building inspector. It's important to be as well informed as possible, especially before making any mechanical room changes.

Equipment Design

Manufacturers' labels reference compliance with the standard, so it's easy to check to ensure that anything installed in your building will comply.

Contracts

It's a good idea to include the specification that all equipment and service "must be in compliance with the latest ASHRAE 15" as standard language for all your installation submittals, service agreements and contracts.

Key Steps to Compliance

When examining your mechanical equipment room for compliance with ASHRAE 15-1994, here are some of the primary issues to consider.

Do I Need a Mechanical Room?

The standard lists allowances for all refrigerants in pounds of refrigerant per 1,000 cu. ft. of occupied space (this allowance is calculated for the occupied space in the building and does not apply to the mechanical room). These figures represent the maximum refrigerant levels allowable for refrigeration equipment installed in "occupied" portions of the building. If your system has more than the allowable amount of refrigerant, it must be housed in a separate mechanical room.

Purge System and Relief Devices

The standard specifies that all purge systems (including high efficiency systems) and other relief devices must vent outside. Even the highest-efficiency purges lose some refrigerant. If vented to the chiller relief piping, refrigerant can condense, coming into contact with safety rupture disks and promoting corrosion.

Sizing of Relief and Rupture Devices

ASHRAE 15-1994 specifies the appropriate sizing of pressure relief devices. It also includes rating formulas for discharge capacity of rupture members and maximum length of discharge piping. When converting a chiller to a new refrigerant, it is critical to check the size of existing safety devices to be sure they are suitable.

Refrigerant Sensors

All mechanical rooms must have sensors capable of detecting refrigerant loss. They should be positioned where vapor from a refrigerant leak would most likely concentrate, providing early warning so that personnel can prevent dangerous exposure and catastrophic refrigerant loss. The sensors should trigger an alarm and mechanical ventilation, as well as activate visual and audible alarms inside and outside the mechanical room.

Mechanical Ventilation to the Outdoors

Mechanical rooms must be vented to the outdoors using mechanical ventilation. ASHRAE provides a formula for calculating ventilation capacity requirements.

Access Restrictions

Mechanical rooms must have tight-fitting doors that open and close freely (i.e., no fire doors), and any other opening that would permit the passage of refrigerant must be sealed. Each entrance to a refrigerating machinery room must have a legible permanent sign that reads "Refrigerating Machinery Room — Authorized Personnel Only," and should communicate that when an alarm has been activated, entry is forbidden except by trained personnel who can address emergencies.
Refrigerant Storage

Section 11.5 of ASHRAE 15-1994 reads: “The total amount of refrigerant stored in a machinery room in all containers not provided with relief valves and piped in accordance with the standard, should not exceed 330 lbs.” This is designed to allow building owners to store adequate quantities of refrigerant for chiller servicing in separate, approved storage tanks. However, you should check your local building and fire codes for possible exceptions.

Relief Discharge Location

The discharge location of relief devices must be at least 20 feet away from any ventilation openings, and not less than 15 feet above ground level (to avoid spraying someone with refrigerant).

Combustion Device Limitation

ASHRAE 15-1994 prohibits the location of an open-flame device using combustion air from inside the room. On the other hand, an open-flame device such as a boiler may be located in a mechanical room — if combustion air is drawn from a sealed outside source, or the boiler is shut off through the use of refrigerant sensor cut outs.

Room Dimensions

The new standard defines an appropriately sized mechanical room as one that allows access to all equipment, including adequate space for service and maintenance, as well as operation.

Periodic Testing

Ventilation systems and sensors must be periodically tested in accordance with the manufacturer’s recommendation and/or local jurisdiction. This is particularly important for refrigerant sensors that are detecting compounds with low allowable exposure limits.

M any of these sensors require frequent calibration. (Higher quality sensors using infrared technology are preferred over metal-oxide types, as they remain close to set calibrations.)

Emergency Planning

The original version of ASHRAE 15-1994 mandated the availability of self-contained breathing apparatus (SCBA) for refrigerant leak situations. Addendum “d” to the standard has removed this requirement because of the difficulty of implementation for many commercial buildings.

The addendum mandates an emergency response plan that will allow appropriate measures according to the severity of each potential emergency. Some considerations for the plan include: types of detection and alarms; ventilation activation; respiratory protection; evacuation; and, most importantly, a properly trained response team.

Read ASHRAE 15-1994

Clearly, there are many issues to consider in order to achieve compliance with ASHRAE 15-1994 and its addenda. Your best strategy is to obtain a copy of the standard. This issue of Synopsys and consultation with an HVAC expert can help you clarify and understand the standard as it applies to your building.

ASHRAE 15-1994 offers many good, safe solutions, which can and should become part of your overall strategic refrigerant planning. A sound plan will help you to meet the increasingly complex challenges surrounding refrigerant regulation — and maintain a safe environment for your building’s employees and occupants.