Safety standard developments within ASHRAE 15 and ISO 5149

UNEP workshop on safety standards, Bangkok

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Topics for this presentation

- Purpose of standards and principles underpinning them
- Status of ASHRAE Standard 15 and ISO Standard 5149 with respect to low GWP refrigerants
- Relationship and coordination between safety standards and product standards
- Committee structure and make-up
- Can safety standards can be considered technology stoppers or technology stimulators?
ISO Standards 817 and 5149

Refrigerants — Designation and safety classification
Fluides frigorigènes — Dénomination et classification de sécurité

Refrigerating systems and heat pumps — Safety and environmental requirements
Part 1: Definitions, classification and selection criteria
Systèmes frigorifiques et pompes à chaleur — Entiègnes de sécurité et d’environnement
Partie 1: Définitions, classification et critères de choix

ISO 817:2014
ISO 5149-1, 2, 3, and 4:2014

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ANSI/ASHRAE Standards 15-2016 & 34-2016

Safety Standard for Refrigeration Systems

Designation and Safety Classification of Refrigerants

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Development within ASHRAE 15 and ISO 5149

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ASHRAE 34 and ISO 817
Refrigerant Concentration Limits (RCLs)

• Refrigerant Concentration Limit (RCL) is the lowest of these three factors:
  • Acute Toxicity Exposure Limit (ATEL)
  • Oxygen Deprivation Limit (ODL) (or Asphyxiation)
  • Flammability
    • 25% of the LFL in ASHRAE 34
    • 20% of the LFL in ISO 817

• These two standards are similar. There is an ongoing effort to harmonize them.
Refrigerants are assigned one of four flammability classes:

- **1**: No flame propagation
- **2L**: Difficult to ignite and sustain
- **2**: Lower flammability
- **3**: Higher flammability

Developments within ASHRAE 15 and ISO 5149

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Purpose and Scope:

… specifies safe design, construction, installation, and operation of refrigeration systems

… establishes safeguards for life, limb, health, and property and prescribes safety requirements.

… applies to the design, construction, test, installation, operation, and inspection of mechanical and absorption refrigeration systems, including heat pump systems used in stationary applications.
ANSI/ASHRAE Standard 15-2016

Classification Criteria

Building occupancy type
   Speed of evacuation

Refrigerating system type
   Probability of occupant exposure

Refrigerant safety group (as established in ASHRAE Standard 34)
   Toxicity and flammability
High Probability System

... system in which the basic design, or the location of components, is such that a leakage of refrigerant from a failed connection, seal, or component will enter the occupied space...

Definition: occupied space: that portion of the premises accessible to or occupied by people, excluding machinery rooms.

Low-Probability System

... leakage of refrigerant from a failed connection, seal, or component cannot enter the occupied space.

Typically, Low Probability systems use a secondary fluid, such as chilled water. The refrigeration equipment is located in a machinery room or outside.
Section 7: Restrictions on Refrigerant Use

- **Section 7** can be considered as the “heart” of Standard 15 from the standpoint of establishing restrictions on refrigeration system application.

- **Basic premise – limit charge quantities in high probability systems**
  
  - **7.2 Refrigerant Concentration Limits.** The concentration of refrigerant in a complete discharge of each independent circuit of high-probability systems shall not exceed the amounts shown in Table 1 or 2 of ASHRAE Standard 34, except as provided…

- **Takeaway – assure that occupants will be safe if the entire refrigerant charge is discharged into the smallest occupied space in which it could discharge to.**

- **Systems with a larger charge quantity must go into a machinery room or outdoors.**
9 Design and Construction of Equipment and Systems Product listing in accordance with product standards is not a prerequisite, but such listing can be used to demonstrate compliance with ASHRAE 15.
Future Changes to ASHRAE Standard 15

- Standard 15 presently includes requirements for class 2 and 3 refrigerants. Those requirements have been largely unchanged for several years.
- No specific requirements exist at present for 2L refrigerants. An update is ongoing. Proposed changes are going through a Public Review process.
- A proposed new standard, 15.2, is under development, specifically for Residential Applications. It will include low GWP refrigerants.
A Brief Overview of ISO 5149

ISO 5149

Refrigerating systems and heat pumps — Safety and environmental requirements —
Part 1: Definitions, classification and selection criteria

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ISO 5149-1, 2, 3, and 4:2014

- Concept of protecting occupants from unsafe refrigerant discharge is similar to that of ASHRAE Standard 15.

- ISO 5149-1:2014 Section 5 includes important classifications:
  - 5.1 Occupancy classifications.
  - 5.2 Systems classification.
  - 5.3 Location classification of refrigerating systems.

- As with Section 7 of ASHRAE 15, the heart of the standard are the following sections:
  - 6 Quantity of refrigerant per occupied space,
  - 7 Space volume calculations, and
  - Annex A Location of refrigerating systems
ISO 5149-1, 2, 3, and 4:2014

Relationship to Product Standards

- ISO 5149-2:2014 Section 4 Requirements for components and piping.
  - Refrigerating appliances or systems constructed according to product standards such as IEC 60335-2-24, IEC 60335-2-89, and IEC 60335-2-40 are presumed to be in conformity with this part of ISO 5149.
ISO 5149-1, 2, 3, and 4:2014

- **ISO 5149** includes requirements for all flammability classifications.
Committee structure and make-up.

- ASHRAE and ISO follow different approaches for committee structure and make-up.
Committee structure and make-up.
ASHRAE Standards

- ASHRAE SSPC-15 is the responsible committee.

- Changes can be proposed from committee members or by members of the public at large. The committee is required to consider and respond to all such proposals.

- ASHRAE procedures comply with ANSI Essential requirements for due process, including:
  - Openness
  - Lack of dominance
  - Balance (of membership)

- Voting is by Voting Membership on the committee.

- Proposed changes go through a Public Review process.
ISO Standards

- ISO TC86/SC1 overseas the work of Working Group WG1. WG1 operates by consensus and submits its proposed actions to SC1, for consideration by that committee. Working Groups are composed of experts.

- SC participation is through National Bodies. National bodies determine if they will participate as P-members or O-members.

- Voting is by P-members.

- Input is provided through the National Bodies of P-member and O-member countries, and not through the public at large. Individuals must participate through their National Body.
Committee structure and make-up.
ISO & ASHRAE Standards

- Important **resources required for standards development:**
  - Experts with relevant technical knowledge
  - Reliable, state of the art technical information.
  - Real world experience can be used to guide committee decisions
  - Funding to cover the cost of time and travel
Can safety standards can be considered technology stoppers or technology stimulators?

Before addressing this question, it is important to consider the users of standards. In the US and other locations, the final decision regarding compliance with standards lies with building code officials. Standards must be written in an unambiguous way, so that officials can interpret the requirements in a safe and consistent manner.

Standards can be written using prescriptive or performance-based requirements.

- **Prescriptive requirements** generally allow little latitude for new technology.
- **Performance-based requirements** focus on achieving a specified outcome and are intended to allow for different technologies.

Both approach types are used.

While performance based requirements are less technology specific, they can be difficult to create.

When prescriptive approaches mandate specific technology, alternate technologies can be evaluated by the committee and included, if comparable safety can be demonstrated.
Thank You