

NEW SCIENCE

SUSTAINABLE ENERGY

ARTICLE

ADVANCING FLAMMABLE REFRIGERANT ADOPTION IN NORTH AMERICA

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NEW SCIENCE **SUSTAINABLE ENERGY** OVERVIEW

Rising costs, energy efficiency and environmental impact demand innovations in energy generation, distribution, management and usage. UL's team of dedicated scientists, engineers and researchers are developing New Science to make energy cleaner, more reliable, more efficient and more secure.

WHY FLAMMABLE REFRIGERANT ADOPTION MATTERS

The U.S. and other governments have banned or are phasing out the use of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) as refrigerants in heating, ventilation, air-conditioning and refrigeration (HVAC/R) equipment. The impetus for this shift is the high global warming potential (GWP) values of these substances and the damage they have done to the ozone layer. The ozone layer shields us from the harmful effects of solar radiation, including higher rates of skin cancer and cataracts as well as crop damage.¹ A number of hydrocarbon-based refrigerants are much more environmentally friendly than those previously used. However, these new refrigerants are flammable and increase the risk of fire. UL is helping ensure the safety of flammable refrigerants, facilitating their adoption and protecting the environment while enabling manufacturers to meet compliance requirements around the world, including the U.S. Clean Air Act.

CONTEXT

For more than 60 years, CFCs were the refrigerant of choice for the HVAC/R industry.² By the mid-1970s, however, scientists began to express concern about their negative impact on the ozone layer. In 1978, the U.S. government banned CFCs as propellants in most aerosol uses.³ Additional scientific evidence about the deterioration of the ozone layer led to the 1989 Montreal Protocol — unanimously ratified by the U.S. and 196 other United Nations countries — which was designed to eliminate the production and consumption of chemicals that destroy stratospheric ozone.⁴ In response to this protocol, the U.S. Congress passed the 1990 Clean Air Act requiring the Environmental Protection Agency (EPA) to set up a program to phase out the production and use of ozone-destroying chemicals.⁵ This move was consistent with compliance requirements around the globe that banned the use of CFCs and eventually HCFCs because of their detrimental effect on the environment.

The phaseout of CFCs began in 1991; this drove equipment manufacturers in the U.S. to adopt HCFCs as an interim solution, while manufacturers in Europe and Japan also began using the flammable hydrocarbon refrigerant isobutane in household refrigerators and freezers.⁶ The EPA's transition schedule for HCFCs mandated a 75 percent reduction in consumption and production by 2010, 90 percent by 2015, 99.5 percent by 2020 and 100 percent by 2030.⁷ Anticipating the introduction of flammable refrigerants in the U.S., UL developed the flammable refrigerant supplement to the safety standard ANSI/UL 250, initially proposed on March 17, 1993.⁸

The EPA, through its Significant New Alternatives Policy (SNAP) program, authorized the use of hydrocarbon (HC) flammable refrigerants for industrial process refrigeration in 1994.⁹ But it was not until December 2012 that the EPA authorized the use of flammable refrigerants in household refrigerators, freezers, combination refrigerator-freezers and commercial stand-alone units. The three refrigerants authorized were isobutane, propane and the hydrocarbon blend R-441A.¹⁰

With the mandated reductions in HCFC usage, the EPA's recognition of certain hydrocarbon refrigerants as suitable alternatives for household and commercial refrigeration will likely accelerate manufacturer demand in the U.S. However, these refrigerants present a risk of fire and explosion if they leak, which can occur during installation, usage or disposal of the appliance. Hot surfaces and electrical arcs are the principal potential ignition sources for HVAC/R appliances.¹¹ Given these issues, it was clear that new safety standard and installation code content was needed to help ensure the safe and efficient introduction of flammable refrigerants in the U.S.



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WHAT DID UL DO?

Anticipating the need, UL implemented an innovative, collaborative approach that brought together a range of stakeholders at a Flammable Refrigerant Stakeholder Forum. Participants included HVAC/R manufacturers, industry consultants, trade associations (such as the Air Conditioning, Heating and Refrigeration Institute; the Association of Home Appliance Manufacturers; and the Air Conditioning Contractors of America); environmental interests (Greenpeace); representatives of codes and standards bodies (the International Code Council); government organizations (the EPA and the Consumer Product Safety Commission); and professional associations (the International Association of Fire Chiefs, the Virginia State Fire Marshals and the National Association of State Fire Marshals).¹²

The belief underlying UL's unique approach is that the best way to promote public safety is to address it systemically. Safety standards are a critically important part of an effective safety system, but other elements are also important, including the efforts of producers, installers, code authorities and enforcement officials as well as the knowledge of equipment users and service personnel.¹³ Getting all the key stakeholders on the same page was intended to speed the adoption process of more environmentally friendly refrigerants (that happen to be flammable) in a safer, efficient way. The forum was designed to elicit perspectives and stimulate discussion among this diverse group of stakeholders, with a focus on current and anticipated issues related to the usage of flammable refrigerants in HVAC/R equipment in the U.S. Having an informed and current understanding of the perspectives of relevant stakeholders is a best practice that UL uses to anticipate changing equipment capabilities, along with the safety and related issues that new and updated safety standards must address.

In addition to the lessons learned from the Flammable Refrigerant Stakeholder Forum, UL leveraged insights gained from what manufacturers in Europe and Japan experienced with flammable refrigerants. All this information was shared with a Flammable Refrigerants Joint Task Group, which was formed by UL to develop up-to-date and consistent requirements for U.S. refrigeration and HVAC equipment safety standards. The joint task group established three working groups (WGs) to carry out this responsibility:

- WG1 is focused on developing requirements and additions or changes to existing standards for flammable refrigerants applicable to air-conditioning equipment.
- WG2 is developing similar requirements and standards recommendations for refrigeration equipment.
- WG3 is addressing requirements for the testing and evaluation of flammable refrigerants (including the new 2L types), taking into consideration the recommended requirements of the two equipment WGs.¹⁴

IMPACT

UL is bridging fire safety and environmental safety by developing a comprehensive set of new and updated safety standards for the commercial and residential use of EPA-approved flammable refrigerants for HVAC/R equipment. These standards and the innovative approach that UL utilized are advancing the transition to refrigerants that are hydrocarbon-based, ozone-friendly and low in GWP value by helping ensure the safe installation, usage and eventual disposal of the new HVAC/R equipment that uses flammable refrigerants.

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