Finding the Right Odorants for Flammable Refrigerants

As the HVAC&R industry uses more low-global warming potential (GWP) refrigerants that could be flammable, a leak could create a flammable vapor cloud that if ignited could result in severe consequences. Refrigerants are odorless and colorless, and refrigeration equipment generally does not include refrigerant loss monitoring, said Eric Forssell, a senior engineer with Jensen Hughes. Currently there is no provision to warn of a refrigeration leak, so an ASHRAE research project focused on finding suitable odorants for flammable refrigerants to act as a warning mechanism.

1794-RP, White Paper Investigation Relating to the Use of Odorants in Flammable Refrigerants, provides a detailed literature survey to identify odorants in different industries to help the HVAC&R industry identify suitable odorants to use with flammable refrigerants. The final report was released in January.

Implementing odorants in the refrigerant application has a technical barrier: providing an effective warning while not impacting the refrigerant's efficiency, the equipment's reliability or the safety classification of the refrigeration, according to ASHRAE 1794-RP.

To address odorants' main technical barrier, the report has a three-part approach: a literature review of existing odorants in various industries and applications, identification of viable odorants and an outline of the development and implementation process with potential challenges to implement and apply an odorant to the refrigeration loop. The literature review identified more than 200 odorant candidates—many of which are used in the natural gas industry. Of those candidates, 11 had boiling points similar to primary A2L and A3 refrigerants.

"The primary challenge or surprise with the research was how quickly the list of candidate odorants narrowed with the need to have a similar boiling point to the candidate refrigerants and to be non-toxic at concentrations above their detection threshold," said Forssell, the principal investigator.

He said the number of potential candidates narrowed significantly because of the requirement for the odorant to remain with the refrigerant thorough out the refrigerant loop and not accumulate in the compressor lubricant reservoir.

After addressing reactivity and material compatibility, four potential odorants were identified: Hydrogen sulfide (H2S), Carbonyl sulfide (COS), trimethylamine ((CH3)3N) and methyl mercaptan (CH4S).

"The identified candidates need further evaluation to determine if they can be successfully applied. This further evaluation would concentrate on material compatibility, the amount of odorant required to be added and the reliability of the warning provided," said Forssell.