

memorandum

AE: October 6, 1997

YFO
WEH EH-41

BE Discussion of HCFC 123

EH-41 Web site users

The following article discusses HCFC 123 & 124 as potential health hazards. The article, however, is not official "DOE guidance," and is offered only as general information which may be of use to our Web users.

Please access our [ODS Open Forum](#) for informal discussions of HCFCs and other issues related to ozone-depleting substances.

The R-123 Question

Introduction

A recent article in the highly respected British medical journal *The Lancet* (Vol. 350, No. 9077, August 23, 1997) reported an incident where nine Belgian workers were exposed to a HCFC 123-124 blend. These exposed workers were diagnosed with acute Hepatitis, an infection of the liver. This report has generated significant interest in the air conditioning and refrigeration community because of the increasing use of R-123 in new installations. The article labeled HCFC 123 & 124 as health hazards and calls for developing “safer alternatives” because of the potentially widespread use of these new refrigerants. (The full text of the article is located on the web at www.thelancet.com)

Background

The article described the conditions where the workers were exposed. All the workers were employed as operators of an overhead gantry crane in a smelting plant. Their working station was the control cab, which used a space conditioning system to provide the workers protection from the heat of the smelting operations. The cab where the exposure occurred was small (approximately 250 ft³) and the exposure took place over an extended period of time. Each of the workers reported to the medical facility and was diagnosed with acute liver infections.

After investigation it was determined that due to improper installation, use of plastic pipe, the cooling system refrigerant was being released directly into the control cab. The refrigerant was a mixture of HCFC 123 & 124 and had been used to replace CFC-114. This is an unusual mixture and the system design was such that a concentration of the leaking mixture could easily concentrate in the control cab.

Discussion

The design of the space conditioning system used in the crane cab at the Belgian plant was quite unusual in that it allowed refrigerant to flow through components located in the actual conditioned space. The following enumerates the design issues identified with the Belgian application:

- the design used plastic piping and materials not normally compatible with the refrigerant used (not allowed by the International Mechanical Code)
- the HCFC 123-124 blend is not listed as an acceptable substitute on the EPA’s SNAP list

- there was not a refrigerant leak detector and alarm installed in the control cab as required by ASHRAE Standard 15-1994
- it did not use a secondary loop (water or brine) for conditioning the space which allowed the refrigerant blend to enter directly into the control cab

These design items are not normally accepted practices and the erosion of the plastic pipe in the closed space resulted in the established safe exposure limits being exceeded for a prolonged period of time. This exposure level most likely did result in the acute hepatitis attacks suffered by the operators.

Conclusions

The design flaws in the cooling system used in the elevated crane control cab resulted in a prolonged exposure to a HCFC refrigerant blend that is not an approved refrigerant substitute. The length and concentration of the exposure exceeded the established limits for HCFC-123 and went undetected because there was no refrigerant leak detector and alarm installed in the space. There were numerous violations of accepted safety practices.

To label the HCFC-123 as an unsafe refrigerant based on this incident given the list of unacceptable handling practices that most likely occurred in this case is not reasonable. The current HCFC-123 chiller applications have demonstrated conclusively that the exposure in equipment rooms remain well within the safety limits during both normal operation and servicing.

The use of HCFC-123 as a substitute refrigerant, when handled according to established practices, is a safe and efficient chemical for chiller use.

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