Fact-sheet 16

MRGL - Maximum Recommended Guidance Level for fluorocarbons impurities.

Maximum recommended guidance levels (mrgls) for organohalogenated impurities.

Occupational Exposure Levels (OELs) exist for many fluorocarbons. Unless present in a blend, OELs rarely consider the presence of other substances. For blends of two or more fluorocarbons that may present additive toxicity, the American Conference of Industrial Hygienists (ACGIH) has published a method for estimating an OEL for the blend.

This is based on the following relationship:
$Xa/OELa + Xb/OELb \ldots = 1/OELblend$, where

- Xa is the mole fraction of "a",
- OELa is the OEL for "a", etc.

A methodology has been derived by EFCTC for estimation of acceptable levels of impurities or contaminants in chemical products, meaning by "acceptable levels" the levels of impurities which would not significantly impact on the OEL for the product.

It is most applicable for cases where the product has a low toxicity and correspondingly high OEL while the impurity has a high toxicity and correspondingly low OEL. In this case the presence of a significant amount of the impurity could mandate a lower OEL to afford the same level of protection to those using this substance.

The procedure involves first determining the OELs for the product and identified impurities either by using established OELs for these substances or when not available estimating them from OELs for similar substances.

Safety factors are applied to account for additive toxicity and the potential for the impurity to fractionate. Treatment for multiple impurities, again assuming additive toxicity, is also considered.

For a product with a single impurity:
The MRGL = [(Impurity OEL/safety factor x Impurity Mol. Wt)/ (product OEL x product mol. Wt.)] x 100.

Example

HFC-134a contains F-133a as an impurity. What is the MRGL of F-133a in liquefied commercial HFC-134a?

HFC-134a: Mol Wt = 102 ; OEL = 1000 ppmV F-133a: Mol Wt = 118.5; OEL = 1 ppmV

- **Step 1.**
  Apply the default uncertainty factor of 30 to the impurity OEL to account for fractionation and interactive effects: 1 ppmV F-133a / 30 = 0.03 ppm V of F-133a.
- **Step 2.**
  Convert proportion to weight % basis. The following general equation can be used to calculate the weight % proportion.

MRGL = ((Impurity OEL/UF x Impurity MW) / (product OEL x product MW)) x 100 (Eq 1)

Therefore:

MRGL for F-133a as in impurity in HFC-134a = ((1/30 x 118.5) / (1000 x 102)) x 100
MRGL = (3.95 / 102000) x 100 = 0.0039 wt.% (39 ppm W/W, 39 mg/kg)