



The Situation Now



F-gas Regulation
Information about the planned revision of the F-gas Regulation
(EC) No 842/2006

Low GWP refrigerants will be the future, we will see increasing international activity to phase down HFC usage.

At Chillventa a few days ago, the President of the IIR said the USA will adopt HFC phase down patterns similar to European F gas regulations.

The pace at which the USA is changing has increased, with direction coming from the President e.g. recent action by EPA against Costco for violation of the federal clean air act.

California relaxing some regulations for NH₃ systems with charges less than 100 lbs

Only a matter of time before Australia will fall back into step with developed nations.



The History

| generation | timing | determinant | examples |
|------------|------------------------------|-----------------------|---|
| 1 | 1830-1930s (~100 years) | whatever worked | ethers, acids, CO ₂ , NH ₃ , SO ₂ , hydrocarbons, H ₂ O, CCl ₄ , HCCs, ... |
| 2 | 1930s-1990s (60-65 years) | safety and durability | CFCs, HCFCs, HFCs, NH ₃ , H ₂ O, ... |
| 3 | 1990s-2010s (20-25 years) | ozone protection | (HCFCs), HFCs, NH ₃ , H ₂ O, HCs, CO ₂ , ... |
| 4 | 2012- (?) | global warming | low GWP (short τ_{atm}), ~0 ODP, high efficiency |



Is This Generation Likely to End the Periodic Churn of Refrigerants ?

- The key note paper presented at the Gustav Lorentzen Conference in China 2014 ,JM Calm posed the question .
- He said “ Despite competitive zeal for natural vs fluorinated refrigerants and highly competitive promotion of individual selections and especially proprietary blend formations , **there is a foreboding sense that all may not be enough . Following these transitions to a fourth generation of refrigerants , it is fair to ask whether even the fourth will survive?**”
- He noted in the past , chronic toxicity concerns only emerged late in the testing life of refrigerants . Are the new refrigerants being rushed to the market ?
- Incomplete assessment of future issues from build up of toxic decomposition products in bodies of water and cross boarder contamination issues



Consider Natural Refrigerants

- In the future, **all** refrigerant solutions both **HVAC** and **Refrigeration** will use refrigerants that are:

- I. Flammable
- II. Toxic
- III. High pressure
- IV. Or a combination of all three



The safety practices that are already used by practitioners using ammonia & CO₂ refrigerants, need to be used in **all future** refrigeration applications employing toxic and flammable refrigerants-natural and synthetic.



The Issues we all have to consider

- Charge limits e.g. ISO 5149 to replace AS1677
- Leak detection & checking ,LEL sensors
- Plant room design, locations , exhaust ventilation , scrubbing
- Electrical safety
- Increased skill levels required for installation & design
- More rigorous skills based licensing & National safety regulations



Consistency of Safety and Installation Practices

(Courtesy S Jensen)

| Property | R32 | R717 |
|----------------------------------|---|--------------|
| LEL/LFL % by volume | 14.4 | 15.0 |
| Burning velocity cm/s | 6.7 | 7.2 |
| Auto ignition temperature oC | 648 | 651 |
| Minimum Ignition Energy mJ | 30 | 100 |
| Heat of combustion MJ/kg | 9.4 | 18.6 |
| LD50 ppm (inhalation rat 1 h) | No information | 7,338-11,590 |
| LC50 ppm (rat 4h) | 520,000 | - |
| Hazardous decomposition products | Carbonyl fluoride, hydrogen fluoride , trifluoroacetic acid | Hydrogen gas |



Conclusions

- Mr Calm concludes

Fluorinated vs non fluorinated (natural)

“We cannot afford careless elimination of either group and competition between them on safety (application and fabrication) and performance (especially efficiency) will benefit both.”

