Ammonia (Natural Refrigerant)

Ammonia has been successfully used as a refrigerant in industrial refrigeration plants for over 130 years. It is a colourless gas, liquefies under pressure, and has a pungent odour. Ammonia has no ozone depletion potential (ODP = 0) and no direct global warming potential (GWP = 0). Thanks to its high energy efficiency, its contribution to the indirect global warming potential is also low. Ammonia is flammable and is toxic to skin and mucous membranes when highly pressurised. However, its ignition energy is 50 times higher than that of natural gas and ammonia will not burn without a supporting flame. Due to the high affinity of ammonia towards (air) humidity it is rated as "hardly flammable". Ammonia is toxic, but has a characteristic, sharp smell which makes a warning below concentrations of 3 mg/m^3 ammonia in air possible. This means that ammonia is evident at levels far below those which endanger health. Furthermore ammonia is lighter than air and therefore rises quickly.

Characteristics:

ODP	0
GWP	0
Appearance	colorless
Odor	distinctive, biting
Solubility in water (20 °C, 1 bar)	0.517 kg or 650 l(g)/l water
Heat of solution	36 kJ/mol
Molecular weight	17.03 kg/kmol
Boiling point (1.013 bar)	-33,3 °C
Density of saturated vapour (20 °C)	6.7025 kg/m^3
Thermic decomposition	> 450 °C
Explosibility limits	15 Vol.-% to 34 Vol.-% 108,000 mg/m^3 to 240,000 mg/m^3
Ignition temperature	650 °C
Ignition energy (20 °C, 101 kPa)	14 mJ
Water content in the cycle	of minor importance
Perception threshold	5 ppm 3,5 mg/m^3

MAK-Value	50 ppm 35 mg/m^3
Nuisance threshold	250 ppm 175 mg/m^3
Tolerance threshold	500-1,000 ppm 350 -700 mg/m^3
Signs of poisoning	2,500 ppm 1,750 mg/m^3
Fatal dose	> 5,000 ppm 3,500 mg/m^3
Long-term effects	not carcinogenic, not mutagenic
Concentration in human blood	0,8-1,7 ppm
Daily production in the human body	17 g ˜ 1 mol
Water hazard class	2, ID No. 211
Evaporation enthalpy at 0 °C	1,262 kJ/kg
Vapor pressure at 0 °C	4.29 bar
Compression ratio at 0 / 35 °C	3.15
Volumetric refrigerating capacity at 0 / 35 °C	3,798.2 kJ/ m^3
Isentropic refrigerating capacity number 0 / 35 °C	6.75
Isentropic final compression temperature 0 / 35 °C	82.6 °C
Heat conductivity of the liquid at 0 °C	518.5 * 10-3 W/mK
Kinematic viscosity of the liquid at 0 °C	2.66 * 10-7 m^2/s
Heat transition (evaporation, condensation)	Very high