Methane density

There is confusion with respect to the conditions implicit in the values of volume of different gases. Some use 0 C, others 15 C and some even 20 or 25 C. Typically the pressure is 1 atm, or 1.013 bar.

For methane, the company Aire Liquide (webpage) presents the following values:

Gas density of the gas phase (1.013 bar and 15 °C (59 °F)) : 0.68 kg/m^3

According to my application of Avogadro, for the same pressure, I find the following values:
0 C, 0.716 kg/m^3.
15 C, 0.678 kg/m^3 (which coincides with Aire Liquide)
20 C, 0.667 kg/m^3
25 C, 0.656 kg/m^3.

IPCC in its Reference Manual (IPCC, 1996, vol. 3, p. 1.124) mentions values of 0.7154 at 0 C and 0.6666 for 20 C. They also mention that, considering that the density depends on the pressure and temperature, these values should be specified when citing volume measurements.

I should add that the PDDs with *approved* methodologies (Salvador da Bahia, Durban landfill, Nova Gerar) DO NOT specify temperatures, and indeed give very different values of methane density

What matters for climate change is methane mass (kg or tonne). Normally, volume (m^3) or flow rate (m^3/h) is measured using some measurement device or instrument, and these volume values are converted to mass (kg o kg/h). An intermediate step usually involves adjusting the measured volume by measured pressures and temperatures to volumes at standard conditions (0 C and 1 atm, equal to 1.013 bar). The resulting volume (called Nm^3) is then converted to mass using the density at these conditions = 0.716 kg/m^3).

Thus, it is important to specify the temperature and pressure conditions when reporting any volume measurements.

Avogadro:

1 gm mole occupies 22.4 litres at 273 K and 1 atm.

C 12.01115
H 1.00797
16.043 g CH4 – 22.414 litres
density (16.043 / 22.414) = 0.7157 g/litre or kg/m^3.