CLAIMS

What is claimed is:

1. An azeotropic or near-azeotropic composition ~~comprising~~ consisting of HFC-1234yf and ~~at least one compound selected from the group consisting of:~~ HFC-1234ye~~, HFC-1243zf, HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143a, HFC-152a, HFC-161, HFC-227ea, HFC-236ea, HFC-236fa, HFC-245fa, HFC-365mfc, propane, n-butane, isobutane, 2-methylbutane, n-pentane, cyclopentane, dimethylether, CF_3SCF_3, CO_2 and CF_3I~~.

2. The composition of claim 1 comprising a composition selected from the group consisting of:

~~about 1 weight percent to about 57 weight percent HFC-1234yf and about 99 weight percent to about 43 weight percent HFC-32;~~

~~about 1 weight percent to about 51 weight percent HFC-1234yf and about 99 weight percent to about 49 weight percent HFC-125;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent HFC-134;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent HFC-134a;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent HFC-152a;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent HFC-161;~~

~~about 1 weight percent to about 60 weight percent HFC-1234yf and about 40 weight percent to about 1 weight percent HFC-143a;~~

~~about 29 weight percent to about 99 weight percent HFC-1234yf and about 71 weight percent to about 1 weight percent HFC-227ea;~~

~~about 66 weight percent to about 99 weight percent HFC-1234yf and about 34 weight percent to about 1 weight percent HFC-236fa;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent HFC-1243zf;~~

~~about 1 weight percent to about 80 weight percent HFC-1234yf and about 99 weight percent to about 20 weight percent propane;~~

~~about 71 weight percent to about 99 weight percent HFC-1234yf and about 29 weight percent to about 1 weight percent n-butane;~~

~~about 60 weight percent to about 99 weight percent HFC-1234yf and about 40 weight percent to about 1 weight percent isobutane;~~

~~about 1 weight percent to about 99 weight percent HFC-1234yf and about 99 weight percent to about 1 weight percent dimethylether;~~

~~about 80 weight percent to about 98 weight percent HFC-125, about 1 weight percent to about 19 weight percent HFC-1234yf, and about 1 weight percent to about 10 weight percent isobutane;~~

~~about 80 weight percent to about 98 weight percent HFC-125, about 1 weight percent to about 19 weight percent HFC-1234yf, and about 1 weight percent to about 10 weight percent n-butane;~~

~~about 1 weight percent to about 98 weight percent HFC-32, about 1 weight percent to about 98 weight percent HFC-125, and about 1 weight percent to about 55 weight percent HFC-1234yf;~~

~~about 1 weight percent to about 50 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-32 and about 1 weight percent to about 98 weight percent HFC-143a;~~

~~about 1 weight percent to about 40 weight percent HFC-1234yf, about 59 weight percent to about 98 weight percent HFC-32 and about 1 weight percent to about 30 weight percent isobutane;~~

~~about 1 weight percent to about 60 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-125 and about 1 weight percent to about 98 weight percent HFC-143a;~~

~~about 1 weight percent to about 40 weight percent HFC-1234yf, about 59 weight percent to about 98 weight percent HFC-125 and about 1 weight percent to about 20 weight percent isobutane;~~

~~about 1 weight percent to about 80 weight percent HFC-1234yf, about 1 weight percent to about 70 weight percent HFC-134 and about 19 weight percent to about 90 weight percent propane;~~

~~about 1 weight percent to about 70 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-134 and about 29 weight percent to about 98 weight percent dimethylether;~~

~~about 1 weight percent to about 80 weight percent HFC-1234yf, about 1 weight percent to about 80 weight percent HFC-134a and about 19 weight percent to about 98 weight percent propane;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-134a and about 1 weight percent to about 30 weight percent n-butane;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-134a and about 1 weight percent to about 30 weight percent isobutane;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-134a and about 1 weight percent to about 40 weight percent dimethylether;~~

~~about 1 weight percent to about 80 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-143a and about 1 weight percent to about 98 weight percent propane;~~

~~about 1 weight percent to about 40 weight percent HFC-1234yf, about 59 weight percent to about 98 weight percent HFC-143a and about 1 weight percent to about 20 weight percent dimethylether;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-152a and about 1 weight percent to about 30 weight percent n-butane;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 90 weight percent HFC-152a and about 1 weight percent to about 40 weight percent isobutane;~~

~~about 1 weight percent to about 70 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent HFC-152a and about 1 weight percent to about 98 weight percent dimethylether;~~

~~about 1 weight percent to about 80 weight percent HFC-1234yf, about 1 weight percent to about 70 weight percent HFC-227ea and about 29 weight percent to about 98 weight percent propane;~~

~~about 40 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 59 weight percent HFC-227ea and about 1 weight percent to about 20 weight percent n-butane;~~

~~about 30 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 69 weight percent HFC-227ea and about 1 weight percent to about 30 weight percent isobutane;~~

~~about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 80 weight percent HFC-227ea and about 1 weight percent to about 98 weight percent dimethylether;~~

about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 40 weight percent n-butane and about 1 weight percent to about 98 weight percent dimethylether;

about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 50 weight percent isobutane and about 1 weight percent to about 98 weight percent dimethylether;

about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 98 weight percent dimethylether and about 1 weight percent to about 98 weight percent CF_3I; and

about 1 weight percent to about 98 weight percent HFC-1234yf, about 1 weight percent to about 40 weight percent dimethylether and about 1 weight percent to about 98 weight percent CF_3SCF_3.

3. The composition of claim 1 or 2 comprising an azeotropic composition selected from the group consisting of:

7.4 weight percent HFC-1234yf and 92.6 weight percent HFC-32 having a vapor pressure of about 49.2 psia (339 kPa) at a temperature of about -25 °C;

10.9 weight percent HFC-1234yf and 89.1 weight percent HFC-125 having a vapor pressure of about 40.7 psia (281 kPa) at a temperature of about -25 °C;

70.4 weight percent HFC-1234yf and 29.6 weight percent HFC-134a having a vapor pressure of about 18.4 psia (127 kPa) at a temperature of about -25 °C;

91.0 weight percent HFC-1234yf and 9.0 weight percent HFC-152a having a vapor pressure of about 17.9 psia (123 kPa) at a temperature of about -25 °C;

17.3 weight percent HFC-1234yf and 82.7 weight percent HFC-143a having a vapor pressure of about 29.5 psia (272 kPa) at a temperature of about -25 °C;

84.6 weight percent HFC-1234yf and 15.4 weight percent HFC-227ea having a vapor pressure of about 18.0 psia (124 kPa) at a temperature of about -25 °C;

51.5 weight percent HFC-1234yf and 48.5 weight percent propane having a vapor pressure of about 33.5 psia (231 kPa) at a temperature of about -25 °C;

98.1 weight percent HFC-1234yf and 1.9 weight percent n-butane having a vapor pressure of about 17.9 psia (123 kPa) at a temperature of about -25 °C;

88.1 weight percent HFC-1234yf and 11.9 weight percent isobutane having a vapor pressure of about 19.0 psia (131 kPa) at a temperature of about -25 °C;

53.5 weight percent HFC-1234yf and 46.5 weight percent dimethylether having a vapor pressure of about 13.1 psia (90 kPa) at a temperature of about -25 °C;

89.1 weight percent HFC-125, 9.7 weight percent HFC-1234yf and 1.2 weight percent isobutane having a vapor pressure of about 40.8 psia (281 kPa) at a temperature of about -25 °C;

3.9 weight percent HFC-1234yf, 74.3 weight percent HFC-32, and 21.8 weight percent HFC-143a having a vapor pressure of about 50.0 psia (345 kPa) at a temperature of about -25 °C;

1.1 weight percent HFC-1234yf, 92.1 weight percent HFC-32 and 6.8 weight percent isobutane having a vapor pressure of about 50.0 psia (345 kPa) at a temperature of about -25 °C;

14.4 weight percent HFC-1234yf, 43.5 weight percent HFC-125 and 42.1 weight percent HFC-143a having a vapor pressure of about 38.6 psia (266 kPa) at a temperature of about -25 °C;

4.3 weight percent HFC-1234yf, 39.1 weight percent HFC-134 and 56.7 weight percent propane having a vapor pressure of about 34.3 psia (236 kPa) at a temperature of about -25 °C;

15.2 weight percent HFC-1234yf, 67.0 weight percent HFC-134 and 17.8 weight percent dimethylether having a vapor pressure of about 10.4 psia (71.6 kPa) at a temperature of about -25 °C;

24.5 weight percent HFC-1234yf, 31.1 weight percent HFC-134a and 44.5 weight percent propane having a vapor pressure of about 34.0 psia (234 kPa) at a temperature of about -25 °C;

60.3 weight percent HFC-1234yf, 35.2 weight percent HFC-134a and 4.5 weight percent n-butane having a vapor pressure of about 18.6 psia (128 kPa) at a temperature of about -25 °C;

48.6 weight percent HFC-1234yf, 37.2 weight percent HFC-134a and 14.3 weight percent isobutane having a vapor pressure of about 19.9 psia (137 kPa) at a temperature of about -25 °C;

24.0 weight percent HFC-1234yf, 67.9 weight percent HFC-134a and 8.1 weight percent dimethylether having a vapor pressure of about 17.2 psia (119 kPa) at a temperature of about -25 °C;

17.7 weight percent HFC-1234yf, 71.0 weight percent HFC-143a and 11.3 weight percent propane having a vapor pressure of about 40.4 psia (279 kPa) at a temperature of about -25 °C;

5.7 weight percent HFC-1234yf, 93.0 weight percent HFC-143a and 1.3 weight percent dimethylether having a vapor pressure of about 39.1 psia (269 kPa) at a temperature of about -25 °C;

86.6 weight percent HFC-1234yf, 10.8 weight percent HFC-152a and 2.7 weight percent n-butane having a vapor pressure of about 18.0 psia (124 kPa) at a temperature of about -25 °C;

75.3 weight percent HFC-1234yf, 11.8 weight percent HFC-152a and 12.9 weight percent isobutane having a vapor pressure of about 19.1 psia (132 kPa) at a temperature of about -25 °C;

24.6 weight percent HFC-1234yf, 43.3 weight percent HFC-152a and 32.1 weight percent dimethylether having a vapor pressure of about 11.8 psia (81.2 kPa) at a temperature of about -25 °C;

35.6 weight percent HFC-1234yf, 17.8 weight percent HFC-227ea and 46.7 weight percent propane having a vapor pressure of about 33.8 psia (233 kPa) at a temperature of about -25 °C;

81.9 weight percent HFC-1234yf, 16.0 weight percent HFC-227ea and 2.1 weight percent n-butane having a vapor pressure of about 18.1 psia (125 kPa) at a temperature of about -25 °C;

86.6 weight percent HFC-1234yf, 10.8 weight percent HFC-152a and 2.7 weight percent n-butane having a vapor pressure of about 18.0 psia (124 kPa) at a temperature of about -25 °C;

70.2 weight percent HFC-1234yf, 18.2 weight percent HFC-227ea and 11.6 weight percent isobutane having a vapor pressure of about 19.3 psia (133 kPa) at a temperature of about -25 °C;

28.3 weight percent HFC-1234yf, 55.6 weight percent HFC-227ea and 16.1 weight percent dimethylether having a vapor pressure of about 15.0 psia (104 kPa) at a temperature of about -25 °C;

48.9 weight percent HFC-1234yf, 4.6 weight percent n-butane and 46.4 weight percent dimethylether having a vapor pressure of about 13.2 psia (90.7 kPa) at a temperature of about -25 °C;

31.2 weight percent HFC-1234yf, 26.2 weight percent isobutane and 42.6 weight percent dimethylether having a vapor pressure of about 14.2 psia (97.8 kPa) at a temperature of about -25 °C;

~~16.3 weight percent HFC-1234yf, 10.0 weight percent dimethylether and 73.7 weight percent CF_3I having a vapor pressure of about 15.7 psia (108 kPa) at a temperature of about -25 °C; and~~

~~34.3 weight percent HFC-1234yf, 10.5 weight percent dimethylether and 55.2 weight percent CF_3SCF_3 having a vapor pressure of about 14.6 psia (100 kPa) at a temperature of about -25 °C.~~

42. The composition as in any of ~~claims 1-3~~ claim 1, further comprising a lubricant selected from the group consisting of polyol esters, polyalkylene glycols, polyvinyl ethers, mineral oil, alkylbenzenes, synthetic paraffins, synthetic napthenes, and poly(alpha)olefins.

~~53~~. The composition as in any of claims ~~1-4~~ 1-2, further comprising a tracer selected from the group consisting of hydrofluorocarbons, deuterated hydrocarbons, deuterated hydrofluorocarbons, perfluorocarbons, fluoroethers, brominated compounds, iodated compounds, alcohols, aldehydes, ketones, nitrous oxide (N_2O) and combinations thereof.

~~64~~. The composition as in any of claims ~~1-4~~ 1-3, further comprising a compatibilizer selected from the group consisting of:

a) polyoxyalkylene glycol ethers represented by the formula $R^1[(OR^2)_xOR^3]_y$, wherein: x is an integer from 1 to 3; y is an integer from 1 to 4; R^1 is selected from hydrogen and aliphatic hydrocarbon radicals having 1 to 6 carbon atoms and y bonding sites; R^2 is selected from aliphatic hydrocarbylene radicals having from 2 to 4 carbon atoms; R^3 is selected from hydrogen, and aliphatic and alicyclic hydrocarbon radicals having from 1 to 6 carbon atoms; at least one of R^1 and R^3 is selected from said hydrocarbon radicals; and wherein said polyoxyalkylene glycol ethers have a molecular weight of from about 100 to about 300 atomic mass units;

b) amides represented by the formulae $R^1C(O)NR^2R^3$ and cyclo-$[R^4CON(R^5)-]$, wherein R^1, R^2, R^3 and R^5 are independently selected from aliphatic and alicyclic hydrocarbon radicals having from 1 to 12 carbon atoms, and at most one aromatic radical having from 6 to 12 carbon atoms; R^4 is selected from aliphatic hydrocarbylene radicals having from 3 to 12 carbon atoms; and wherein said amides have a molecular weight of from about 100 to about 300 atomic mass units;

c) ketones represented by the formula $R^1C(O)R^2$, wherein R^1 and R^2 are independently selected from aliphatic, alicyclic and aryl hydrocarbon radicals having from 1 to 12 carbon atoms, and wherein said ketones have a molecular weight of from about 70 to about 300 atomic mass units;

d) nitriles represented by the formula R^1CN, wherein R^1 is selected from aliphatic, alicyclic or aryl hydrocarbon radicals having from 5 to 12 carbon atoms, and wherein said nitriles have a molecular weight of from about 90 to about 200 atomic mass units;

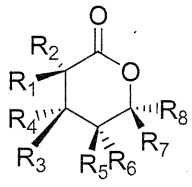
e) chlorocarbons represented by the formula RCl_x, wherein; x is 1 or 2; R is selected from aliphatic and alicyclic hydrocarbon radicals having from 1 to 12 carbon atoms; and wherein said chlorocarbons have a molecular weight of from about 100 to about 200 atomic mass units;

f) aryl ethers represented by the formula R^1OR^2, wherein: R^1 is selected from aryl hydrocarbon radicals having from 6 to 12 carbon atoms; R^2 is selected from aliphatic hydrocarbon radicals having from 1 to 4 carbon atoms; and wherein said aryl ethers have a molecular weight of from about 100 to about 150 atomic mass units;

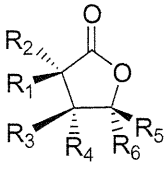
g) 1,1,1-trifluoroalkanes represented by the formula CF_3R^1, wherein R^1 is selected from aliphatic and alicyclic hydrocarbon radicals having from about 5 to about 15 carbon atoms;

h) fluoroethers represented by the formula $R^1OCF_2CF_2H$, wherein R^1 is selected from aliphatic, alicyclic, and aromatic hydrocarbon radicals having from about 5 to about 15 carbon atoms; or wherein said fluoroethers are derived from fluoroolefins and polyols, wherein said fluoroolefins are of the type $CF_2=CXY$, wherein X is hydrogen, chlorine or fluorine, and Y is chlorine, fluorine, CF_3 or OR_f, wherein R_f is CF_3, C_2F_5, or C_3F_7; and said polyols are linear or branched, wherein said linear polyols are of the type $HOCH_2(CHOH)_x(CRR')_yCH_2OH$, wherein R and R' are hydrogen, CH_3 or C_2H_5, x is an integer from 0-4, y is an integer from 0-3 and z is either zero or 1, and said branched polyols are of the type $C(OH)_t(R)_u(CH_2OH)_v[(CH_2)_mCH_2OH]_w$, wherein R may be hydrogen, CH_3 or C_2H_5, m is an integer from 0 to 3, t and u are 0 or 1, v and w are integers from 0 to 4, and also wherein t + u + v + w = 4; and

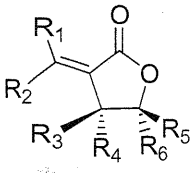
i) lactones represented by structures [B], [C], and [D]:



[B]



[C]



[D]

wherein, R_1 through R_8 are independently selected from hydrogen, linear, branched, cyclic, bicyclic, saturated and unsaturated hydrocarbyl radicals; and the molecular weight is from about 100 to about 300 atomic mass units; and

j) esters represented by the general formula $R^1CO_2R^2$, wherein R^1 and R^2 are independently selected from linear and cyclic, saturated and unsaturated, alkyl and aryl radicals; and wherein said esters have a molecular weight of from about 80 to about 550 atomic mass units.

~~75~~. The composition any of claims ~~1-5~~ 1-3, further comprising at least one ultra-violet fluorescent dye selected from the group consisting of naphthalimides, perylenes, coumarins, anthracenes, phenanthracenes, xanthenes, thioxanthenes, naphthoxanthenes, fluoresceins, derivatives of said dye and combinations thereof.

~~86~~. The composition of ~~claim 7~~ claim 5, further comprising at least one solubilizing agent selected from the group consisting of hydrocarbons, dimethylether, polyoxyalkylene glycol ethers, amides, ketones, nitriles, chlorocarbons, esters, lactones, aryl ethers, hydrofluoroethers, and 1,1,1-trifluoroalkanes.

~~97~~. The composition of any of claims ~~1-8~~ 1-6, further comprising a stabilizer, water scavenger, or odor masking agent.

~~108~~. The composition of ~~claim 9~~ claim 7, wherein said stabilizer is selected from the group consisting of nitromethane, hindered phenols, hydroxylamines, thiols, phosphites and lactones.

~~119~~. A method of producing cooling, said method comprising: evaporating said composition of ~~any of claims 1-3~~ claim 1 in the vicinity of a body to be cooled and thereafter condensing said composition.

~~12~~10. A method of producing heat, said method comprising: condensing said composition ~~of any of claims 1-3~~claim 1 in the vicinity of a body to be heated and thereafter evaporating said composition.

~~13~~11. A method for detecting the composition of any of claims ~~7-8~~5-6 in a compression refrigeration, air conditioning, or heat pump apparatus, said method comprising providing said composition to said apparatus, and providing a suitable means for detecting said composition at a leak point or in the vicinity of said apparatus.

~~14~~12. A method for improving oil-return to the compressor in a compression refrigeration, air-conditioning or heat pump apparatus, said method comprising using the composition of ~~claim 6~~claim4 in said apparatus.

~~15~~13. A method for replacing a high GWP refrigerant in a refrigeration, air-conditioning, or heat pump apparatus, wherein said high GWP refrigerant is selected from the group consisting of R134a, R22, R123, R11, R245fa, R114, R236fa, R124, R12, R410A, R407C, R417A, R422A, R507A, R502, and R404A, said method comprising providing the composition of ~~any of claims 1-3~~claim 1 to said refrigeration, air-conditioning, or heat pump apparatus that uses, used or is designed to use said high GWP refrigerant.

~~16~~14. A method of using the composition ~~of any of claims 1-3~~claim 1 as a heat transfer fluid composition, said process comprising comprises transporting said composition from a heat source to a heat sink.

~~17~~15. A refrigeration, air-conditioning, or heat pump apparatus containing a composition as claimed in any one of claims ~~1-10~~1-8.

~~18~~16. The refrigeration, air-conditioning, or heat pump apparatus of ~~claim 17~~claim 15 comprising a mobile air-conditioning apparatus.

~~19~~17. A foam blowing agent comprising the composition of ~~any of claims 1-3~~claim 1.

~~20~~18. A method of forming a foam comprising:

(a) adding to a foamable composition the composition of ~~any of claims 1-3~~claim 1; and

(b) reacting the foamable composition under conditions effective to form a foam.

~~21~~19. A sprayable composition comprising the composition of ~~any of claims 1-3~~claim 1.

~~22~~20. A process for producing aerosol products comprising the step of adding a composition of ~~any of claims 1-3~~claim 1 to active ingredients in an aerosol container, wherein said composition functions as a propellant.