CLAIMS:

1. A method of screening a hydrocarbon stream for potential toxicological hazards, said method comprising:

providing a hydrocarbon stream;

conducting 2-dimensional gas chromatography (2D-GC) analysis to quantify saturates and aromatic distribution in the hydrocarbon stream;

identifying 2-8 ring aromatic distribution and weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis, wherein the 2-8 ring aromatic distribution comprises mono alkylated aromatic molecules and multi alkylated aromatic molecules;

relating the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis to a mutagenicity index (MI), wherein the MI is determined in accordance with ASTM Standard Method E 1687; and

assessing a potential toxicological hazard of the hydrocarbon stream based on the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis and a MI threshold value.

2. The method of claim 1 wherein the hydrocarbon stream is used for base stock production.

3. The method of claim 1 wherein the hydrocarbon stream is selected from the group consisting of a crude, a distillate, a raffinate, an extract, and a dewaxed oil.

4. The method of claim 1 wherein the hydrocarbon stream comprises a whole crude, total liquid product (TLP) from a process unit, a total liquid product from a research or refinery process, a fraction, distillate or intermediate stream of whole crude, TLP or intermediate, or a fraction, distillate or intermediate stream from a research or refinery process.

5. The method of claim 1 wherein the MI threshold value is 0.4.

6. The method of claim 1 wherein a robustness or strength of the relationship between MI and the weight percentage of 2-8 ring aromatic molecules identified by completing 2D-GC analysis in the hydrocarbon stream is greater or improved as compared to a robustness or strength of the relationship between MI and the weight percentage of 2-8 ring aromatic molecules identified by completing UV analysis or VI analysis in the hydrocarbon stream.

7. The method of claim 1 wherein a MI threshold value above 0.4 is indicative of a presence of 2-8 ring aromatic molecules in the hydrocarbon stream.

8. The method of claim 1 wherein a MI threshold value above 0.4 is indicative of a potential toxicological hazard.

9. The method of claim 1 wherein a MI threshold value below 0.4 is indicative of an absence of 2-8 ring aromatic molecules in the hydrocarbon stream.

10. The method of claim 1 wherein a MI threshold value below 0.4 is indicative of no potential toxicological hazard.

11. The method of claim 1 wherein the 2-8 ring aromatic molecules comprise 3-6 ring aromatics or 3.5-5.5 ring aromatics.

12. The method of claim 1 wherein the MI is determined by a Modified Ames Test in accordance with ASTM Standard Method E 1687 10.

13. A method of characterizing a hydrocarbon stream, said method comprising:

providing a hydrocarbon stream;

conducting 2-dimensional gas chromatography (2D-GC) analysis to quantify saturates and aromatic distribution in the hydrocarbon stream;

identifying 2-8 ring aromatic distribution and weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis wherein the 2-8 ring aromatic distribution comprises mono alkylated aromatic molecules and multi alkylated aromatic molecules; and

relating the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis with a mutagenicity index (MI), wherein the MI is determined in accordance with ASTM Standard Method E 1687.

14. The method of claim 13 further comprising:

assessing a potential toxicological hazard of the hydrocarbon stream based on the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the 2D-GC analysis and a MI threshold value.

15. The method of claim 13 wherein the hydrocarbon stream is used for base stock production.

16. The method of claim 13 wherein the hydrocarbon stream is selected from the group consisting of a crude, a distillate, a raffinate, an extract, and a dewaxed oil.

17. The method of claim 13 wherein the hydrocarbon stream comprises a whole crude, tempered liquefied petroleum gas (TLP) from a process unit, a total liquid product from a research or refinery process, a fraction, distillate or intermediate stream of whole crude, TLP or intermediate, or a fraction, distillate or intermediate stream from a research or refinery process.

18. The method of claim 14 wherein the MI threshold value is 0.4.

19. The method of claim 13 wherein a robustness or strength of the relationship between MI and the weight percentage of 2-8 ring aromatic molecules identified by completing 2D-GC analysis in the hydrocarbon stream is greater or improved as compared to a robustness or strength of the relationship between MI and the weight percentage of 2-8 ring aromatic molecules identified by completing UV analysis or VI analysis in the hydrocarbon stream.

20. The method of claim 14 wherein a MI threshold value above 0.4 is indicative of a presence of 2-8 ring aromatic molecules in the hydrocarbon stream.

21. The method of claim 13 wherein a MI threshold value above 0.4 is indicative of a potential toxicological hazard.

22. The method of claim 14 wherein a MI threshold value below 0.4 is indicative of an absence of 2-8 ring aromatic molecules in the hydrocarbon stream.

23. The method of claim 14 wherein a MI threshold value below 0.4 is indicative of no potential toxicological hazard.

24. The method of claim 13 wherein the 2-8 ring aromatic molecules comprise 3-6 ring aromatic molecules or 3.5-5.5 ring aromatic molecules.

25. The method of claim 13 wherein the MI is determined by a Modified Ames Test in accordance with ASTM Standard Method E 1687 10.

26. A method of screening a hydrocarbon stream for potential toxicological hazards, said method comprising:

providing a hydrocarbon stream;

conducting high detail hydrocarbon analysis (HDHA) to quantify saturates, heteroatom and aromatic distribution in the hydrocarbon stream;

identifying a 2-8 ring aromatic distribution and weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the HDHA analysis, wherein the 2-8 ring aromatic distribution comprises mono alkylated aromatic molecules and multi alkylated aromatic molecules;

relating the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the HDHA analysis to a mutagenicity index (MI), wherein the MI is determined in accordance with ASTM Standard Method E 1687; and

assessing a potential toxicological hazard of the hydrocarbon stream based on the weight percentage of 2-8 ring aromatic molecules in the hydrocarbon stream from the HDHA analysis and a MI threshold value.

27. A composition comprising a middle distillate boiling range refined petroleum stream having a 4.5 ring value of less than about 70 ppm, a final boiling point (FBP) of less than about 1100°F, and a MI of 1.

28. The composition of claim 27 having a kinematic viscosity at 100°C between about 4 and about 12 cSt.

29. The composition of claim 27 having a viscosity index (VI) of at least 75.

30. The composition of claim 27 wherein the middle distillate boiling range refined petroleum stream is a refined lube base stock suitable for formulation in lubricants.

31. A composition comprising a middle distillate boiling range refined petroleum stream having an HDHA ring class value of 4+ ring boiling of about 800 deg. F, a ring value of less than about 0.01% ppm, a final boiling point (FBP) of less than about 1100°F, and a MI of 1.