CLAIMS

1. A method for separating a feed stream in a distillation tower comprising:

providing a distillation tower comprising a controlled freeze zone section, wherein the controlled freeze zone section comprises a melt tray assembly and a spray assembly, wherein the controlled freeze zone section is configured to separate the feed stream into a solid and a vapor stream and wherein the spray assembly introduces a liquid spray into the controlled freeze zone section;

emitting radiation from a first radiation source while the controlled freeze zone section is operating but not generating solids, wherein the first radiation source is coupled to an external surface of the controlled freeze zone wall;

detecting radiation emitted by the first radiation source as a first radiation level with a first radiation detector, wherein the first radiation detector is coupled to an external surface of a controlled freeze zone wall, and wherein the first radiation level is measured while there is vapor within the controlled freeze zone section;

operating the controlled freeze zone to form solids in the controlled freeze zone section of the distillation tower;

detecting radiation emitted by the first radiation source as a second radiation level after detecting the first radiation level, wherein the second radiation level is measured while solids are being formed in the controlled freeze zone section of the distillation tower and while there is liquid and vapor in the controlled freeze zone section of the distillation tower; and

determining whether solids have adhered to at least one of on and around a first mechanical component included in the controlled freeze zone section based on the first radiation level and the second radiation level.

2. The method of claim 1, wherein the first mechanical component comprises one of: (a) a wall of the controlled freeze zone section and (b) a channel of the controlled freeze zone section.

3. The method of claim 1, wherein determining whether the solids adhered comprises: using the first radiation level to generate a baseline radiation level in the controlled freeze zone section and comparing the second radiation level to a radiation deviation range, the radiation deviation range dependent on the baseline radiation level.

4. The method of claim 3, wherein the radiation deviation range comprises a normal radiation deviation range and an abnormal radiation deviation range indicative of solid adhesion, and wherein the method further comprises determining that the solids adhered if the second radiation level is within the abnormal radiation deviation range.

5. The method of claim 1, further comprising emitting radiation from a plurality of first radiation sources; detecting radiation emitted from each of the plurality of first radiation sources as first radiation levels; and detecting radiation emitted from each of the plurality of first radiation sources as second radiation levels.

6. A method for producing hydrocarbons in a distillation tower comprising:

providing a distillation tower comprising a controlled freeze zone section, wherein the controlled freeze zone section comprises a melt tray assembly and a spray assembly, wherein the controlled freeze zone section is configured to separate the feed stream into a solid and a vapor stream and wherein the spray assembly introduces a liquid spray into the controlled freeze zone section;

emitting radiation from a first radiation source while there is vapor in the controlled freeze zone section but while the controlled freeze zone section forms no solids, wherein the first radiation source is coupled to an external surface of the controlled freeze zone wall;

detecting radiation emitted by the first radiation source as a first radiation level with a first radiation detector, wherein the first radiation detector is coupled to an external surface of a controlled freeze zone wall;

forming solids in the controlled freeze zone section of the distillation tower;

detecting radiation emitted by the first radiation source as a second radiation level after detecting the first radiation level, wherein the second radiation level is measured while there is vapor and liquids in the controlled freeze zone section and while solids are being formed in the controlled freeze zone section of the distillation tower;

determining whether solids have adhered to at least one of on and around a first mechanical component included in the controlled freeze zone section based on the first radiation level and the second radiation level; and

producing hydrocarbons from the distillation tower.

7. The method of claim 6, wherein the first mechanical component comprises one of: (a) a wall of the controlled freeze zone section and (b) a channel of the controlled freeze zone section.

8. The method of claim 6, wherein determining whether the solids adhered comprises: using the first radiation level to generate a baseline radiation level in the controlled freeze zone section and comparing the second radiation level to a radiation deviation range, the radiation deviation range dependent on the baseline radiation level.

9. The method of claim 8, wherein the radiation deviation range comprises a normal radiation deviation range and an abnormal radiation deviation range indicative of solid adhesion, and wherein the method further comprises determining that the solids adhered if the second radiation level is within the abnormal radiation deviation range.

10. The method of claim 6, further comprising emitting radiation from a plurality of first radiation sources; detecting radiation emitted from each of the plurality of first radiation sources as first radiation levels; and detecting radiation emitted from each of the plurality of first radiation sources as second radiation levels.

11. The method of claim 6, further comprising using the first radiation level and the second radiation level to determine the thickness of solid accumulation on to or around the first mechanical component.

12. The method of claim 11, further comprising destabilizing the solids that have adhered on to or around the first mechanical component when the thickness of solid accumulation is determined to be greater than or equal to one inch.