CLAIMS:

1. A swing adsorption process for separating contaminant gas components from a feed gas mixture containing at least one contaminant gas component, which process comprises:

a) conducting the feed gas mixture directly to a first adsorption bed in a swing adsorption process unit containing a plurality of adsorbent beds each having a fluid inlet end and fluid outlet end wherein the first adsorption bed has a first primary adsorption cycle defined by the period of time from the start of connecting the fluid input end of the first adsorption bed directly to said feed gas mixture to the end of connecting the fluid input end of the first adsorption bed directly to said feed gas mixture;

b) retrieving a first product stream flow from the fluid outlet end of the first adsorption bed;

c) fluidly connecting the fluid outlet end of the first adsorption bed with the fluid inlet end of a second adsorption bed in the swing adsorption process unit during a point in the first primary adsorption cycle so that at least a portion of the first product stream from the fluid outlet end of the first adsorption bed is passed to the fluid inlet end of the second adsorption bed at which time the second adsorption bed is in a first secondary adsorption cycle which first secondary adsorption cycle is defined by the period of time from the start of exposing the second adsorption bed to the first product stream from the fluid outlet end of the first adsorption bed to the end of exposing the second adsorption bed to the first product stream from the fluid outlet end of the first adsorption bed;

d) retrieving a second product stream flow from the fluid outlet end of the second adsorption bed;

e) fluidly disconnecting the fluid outlet end of the first adsorption bed ~~with~~ from the fluid inlet end of ~~a~~ the second adsorption bed; and

f) conducting the feed gas mixture directly to the second adsorption bed wherein the ~~first~~ second adsorption bed has a second primary adsorption cycle defined by the period of time from the start of connecting the fluid input end of the second adsorption bed directly to said feed gas mixture to the end of connecting the fluid

input end of the second adsorption bed directly to said feed gas mixture, wherein step f) starts prior to the beginning of step e), and wherein the first product stream and the second product stream each have a lower mol% of the contaminant gas component than the feed gas mixture, and the beginnings and ends of the first primary adsorption cycle and the second primary adsorption cycle do not both coincide with each other.

~~2. The process of claim 1, wherein one or more of the following is satisfied: step f) starts simultaneously with or prior to the beginning of step e); step c) starts prior to breakthrough of the contaminant gas component from the first adsorption bed; and step e) starts prior to breakthrough of the contaminant gas component from the second adsorption bed.~~

~~3.~~2. The process of claim 1 ~~or claim 2~~, wherein the adsorption front moves from the first adsorption bed to the second adsorption bed during the first secondary adsorption cycle. ~~or during an overlap of the first primary adsorption cycle and the first secondary adsorption cycle.~~

3. The process of claim 1, wherein the adsorption front moves from the first adsorption bed to the second adsorption bed during an overlap of the first primary adsorption cycle and the first secondary adsorption cycle.

4. The process of claim 1, wherein step c) starts prior to breakthrough of the contaminant gas component from the first adsorption bed.

5. The process of claim 1, wherein step e) starts prior to breakthrough of the contaminant gas component from the second adsorption bed.

~~4.~~6. The process of ~~any one of the previous claims~~ claim 1, wherein the contaminant gas component is selected from CO_2, H_2S, and combinations thereof, ~~e.g., comprises CO_2, and/or wherein the feed gas mixture is comprised of methane.~~

7. The process of claim 1, wherein the contaminant gas component is CO_2.

8. The process of claim 1, wherein the feed gas mixture is comprised of methane.

~~5.~~9. The process of ~~any one of the previous claims~~ claim 1, wherein the first adsorbent bed and the second adsorbent bed are comprised of an 8-ring zeolite, ~~e.g., having a Si/Al ratio greater than about 500.~~

10. The process of claim 9, wherein the zeolite has a Si/Al ratio greater than about 500.

~~6.~~11. The process of ~~any one of the previous claims~~ claim 1, wherein feed gas mixture is comprised of methane and CO_2, wherein CO_2 is the contaminant gas component, and the zeolite has a diffusion coefficient for CO_2 over methane (D_{CO2}/D_{CH4}) greater than 10.

~~7.~~12. The process of ~~any one of the previous claims~~ claim 1, wherein feed gas mixture is comprised of methane and N_2, wherein N_2 is the contaminant gas component, and the zeolite has a diffusion coefficient for N_2 over methane (D_{N2}/D_{CH4}) greater than 10.

~~8.~~13. The process of ~~any one of the previous claims~~ claim 1, wherein feed gas mixture is comprised of methane and H_2S, wherein H_2S is the contaminant gas component, and the zeolite has a diffusion coefficient for H_2S over methane (D_{H2S}/D_{CH4}) greater than 10.

~~9.~~14. The process of ~~any one of the previous claims~~ claim 13, wherein the first adsorbent bed and the second adsorbent bed are comprised of a zeolite selected from DDR, Sigma-1, ZSM-58, and combinations and intergrowths thereof.

~~10.~~15. The process of ~~any one of the previous claims~~ claim 1, wherein the first adsorbent bed and the second adsorbent bed are comprised of a microporous material selected from zeolites, AlPOs, SAPOs, MOFs (metal organic frameworks), ZIFs, carbon, and combinations and intergrowths thereof.

~~11.~~16. The process of ~~any one of the previous claims~~ claim 1, wherein the first adsorbent bed and the second adsorbent bed are comprised of a material selected from cationic zeolites, amine-functionalized mesoporous materials, stannosilicates, carbon, and combinations thereof.

~~12. The process of any one of the previous claims, wherein the first adsorbent bed and the second adsorbent bed are comprised of a zeolite selected from MFI, faujasite, MCM-41, Beta, and combinations and intergrowths thereof.~~

~~13.~~17. The process of ~~any one of the previous claims~~ claim 1, wherein the process is a rapid cycle pressure swing adsorption process wherein a total cycle time is less than ~~200 seconds, *e.g.*, less than~~ 30 seconds.

18. The process of claim 1, wherein the process is a rapid cycle temperature swing adsorption process wherein a total cycle time is less than 200 seconds.

~~14.~~19. The process of ~~any one of the previous claims~~ claim 1, wherein ~~one or more of the following is satisfied:~~ the feed gas mixture is conducted to the first adsorption bed at a pressure greater than 1,000 psig.~~; the first adsorbent bed is cooled to a temperature no more than about 40°C above the temperature of feed gas mixture prior to step a); and at least one adsorbent bed in the swing adsorption process is a parallel channel contactor.~~

20. The process of claim 1, wherein the first adsorbent bed and the second adsorbent bed are comprised of a zeolite selected from MFI, faujasite, MCM-41, Beta, and combinations and intergrowths thereof.

21. The process of claim 1, wherein the first adsorbent bed is cooled to a temperature no more than about 40°C above the temperature of feed gas mixture prior to step a).

22. The process of claim 1, wherein at least one adsorbent bed in the swing adsorption process is a parallel channel contactor.

23. The process of claim 4, wherein step e) starts prior to breakthrough of the contaminant gas component from the second adsorption bed.