CLAIMS

1. A method comprising:

delivering a carbon dioxide injection stream to a first wellhead;

reducing the pressure of the carbon dioxide injection stream with a first pressure reducer having a first depth and producing a reduced pressure carbon dioxide stream;

reducing the pressure of the reduced pressure carbon dioxide stream with a second pressure reducer, wherein the second pressure reducer is positioned at a lower depth than the first pressure reducer, and producing a further reduced pressure carbon dioxide stream;

injecting the further reduced pressure carbon dioxide stream into a reservoir having a reservoir depth; and

combining at least one chemical additive with a raw carbon dioxide stream having a bubble point pressure to produce the carbon dioxide injection stream;

wherein the pressure of the carbon dioxide injection stream at the first depth is greater than a bubble point pressure of the carbon dioxide stream at the first depth; and

wherein the pressure of the further reduced pressure carbon dioxide stream at the reservoir depth is less than a minimum fracture pressure of the reservoir at the reservoir depth wherein the bubble point pressure of the carbon dioxide injection stream is lower than the bubble point pressure of the raw carbon dioxide stream; and

wherein the chemical additive is selected from the group consisting of methane; cyclohexane; dimethyl ethers of polyethylene glycol; and a catalyst that reacts hydrogen with carbon dioxide to form methanol, formate, or formic acid.

2. The method of claim 1, wherein the carbon dioxide injection stream comprises at least 0.1 mol% hydrogen.

3. The method of claim 1, wherein a confining interval is located above the reservoir depth and the second pressure reducer is located at a lower depth than the confining interval.

4. The method of claim 1 wherein the raw carbon dioxide stream comprises hydrogen; and

wherein the at least one chemical additive causes a chemical reaction consuming at least a portion of the hydrogen in the raw carbon dioxide stream.

5. The method of claim 4, wherein the chemical reaction consuming at least a portion of the hydrogen in the raw carbon dioxide stream is exothermic.

6. The method of claim 1, further comprising measuring the pressure of the further reduced pressure carbon dioxide stream at the reservoir depth; and
controlling the pressure of the further reduced pressure carbon dioxide stream at the reservoir depth by changing a flow coefficient of the first pressure reducer and/or a flow coefficient of the second pressure reducer.

7. The method of claim 1, further comprising:
injecting the further reduced pressure carbon dioxide stream into a deeper reservoir having a deeper reservoir depth;
wherein the pressure of the further reduced pressure carbon dioxide stream at the deeper reservoir depth is less than the minimum fracture pressure of the deeper reservoir at the deeper reservoir depth.

8. The method of claim 1, further comprising controlling a temperature of the further reduced pressure carbon dioxide stream by changing the flow coefficient of the first pressure reducer and/or the second pressure reducer.

9. The method of claim 1, further comprising:
delivering a portion of the carbon dioxide injection stream to a second wellhead;
reducing the pressure of the portion of the carbon dioxide injection stream with a third pressure reducer having a third depth and producing a second reduced pressure carbon dioxide stream;
reducing the pressure of the second reduced carbon dioxide stream with a fourth pressure reducer, wherein the fourth pressure reducer is positioned at a lower depth than the third pressure reducer, and producing a second further reduced pressure carbon dioxide stream; and
injecting the second further reduced carbon dioxide stream into a second reservoir having a second reservoir depth;
wherein the pressure of the portion of the carbon dioxide injection stream at the third depth is greater than a bubble point pressure of the portion of the carbon dioxide stream at the third depth;

wherein the pressure of the second further reduced pressure carbon dioxide stream at the second reservoir depth is less than a minimum fracture pressure of the second reservoir at the second reservoir depth.

10. A system comprising:

a first pressure reducer in fluid flow communication with a carbon dioxide injection stream;

a second pressure reducer in fluid flow communication with the first pressure reducer, wherein the second pressure reducer is positioned at a lower depth than the first pressure reducer;

a reservoir in fluid flow communication with the second pressure reducer;

a controller configured to receive an electrical signal from at least one of a first pressure sensor downstream of the first pressure reducer, a second pressure sensor downstream of the second pressure reducer, and a flow sensor on the carbon dioxide stream; and output an electrical signal to control a flow coefficient of the first pressure reducer; and

an injector or a reactor in fluid flow communication with the first pressure reducer configured to combine at least one chemical additive with a raw carbon dioxide stream having a bubble point pressure to produce the carbon dioxide injection stream;

wherein the pressure of the carbon dioxide stream at the first pressure reducer is greater than a bubble point pressure of the carbon dioxide stream at the first pressure reducer;

wherein the pressure of the carbon dioxide stream at the depth of the reservoir is less than a minimum fracture pressure of the reservoir at the depth of the reservoir;

wherein the bubble point pressure of the carbon dioxide injection stream is lower than the bubble point pressure of the raw carbon dioxide stream; and

wherein the chemical additive is selected from the group consisting of methane; cyclohexane; dimethyl ethers of polyethylene glycol; and a catalyst that reacts hydrogen with carbon dioxide to form methanol, formate, or formic acid.

11. The system of claim 10, further comprising a deeper reservoir in fluid flow communication with the second pressure reducer.

12. The system of claim 10, further comprising at least a third pressure reducer in fluid flow communication with the first pressure reducer, wherein the at least third pressure reducer is positioned at a lower depth than the first pressure reducer.

13. The system of claim 10, wherein the controller is further configured to receive an electrical signal from at least a third pressure sensor downstream of an at least third pressure reducer.

14. The system of claim 10, further comprising at least a second reservoir in fluid flow communication with either the second pressure reducer or at least a third pressure reducer.

15. A method comprising:
reacting carbon dioxide with hydrogen in a raw carbon dioxide stream having a bubble point pressure in the presence of a catalyst to produce a treated carbon dioxide stream;
delivering a carbon dioxide injection stream to a first wellhead;
reducing the pressure of the carbon dioxide injection stream with a first pressure reducer having a first depth and producing a reduced pressure carbon dioxide stream;
reducing the pressure of the reduced pressure carbon dioxide stream with a second pressure reducer, wherein the second pressure reducer is positioned at a lower depth than the first pressure reducer, and producing a further reduced pressure carbon dioxide stream; and
injecting the further reduced pressure carbon dioxide stream into a reservoir having a reservoir depth;
wherein the pressure of the carbon dioxide injection stream at the first depth is greater than a bubble point pressure of the carbon dioxide stream at the first depth;
wherein the pressure of the further reduced pressure carbon dioxide stream at the reservoir depth is less than a minimum fracture pressure of the reservoir at the reservoir depth;
wherein the bubble point pressure of the treated carbon dioxide stream is lower than the bubble point pressure of the raw carbon dioxide stream; and
wherein the carbon dioxide injection stream comprises the treated carbon dioxide stream.