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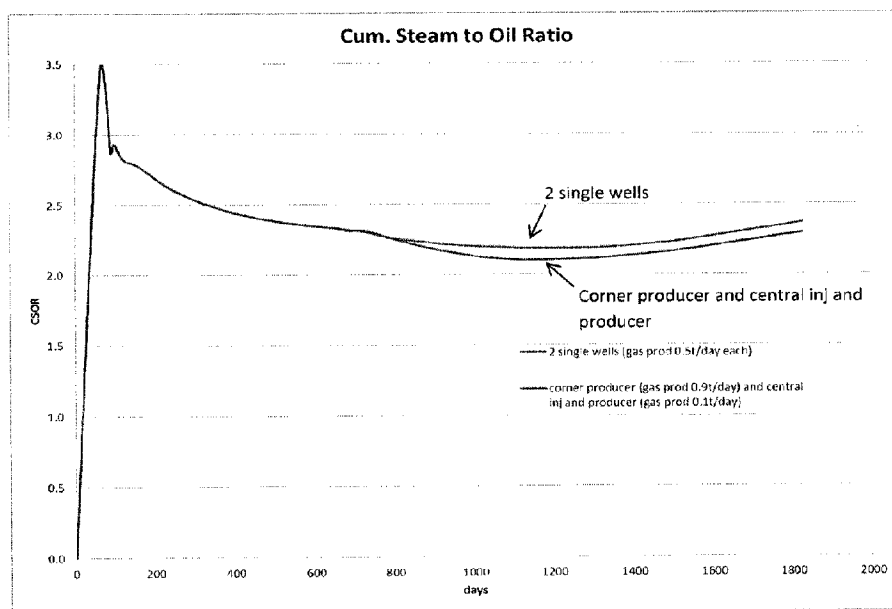
(72) **Inventeurs/Inventors:**
SOOD, ARUN, CA;
WINESTOCK, ALVIN, CA

(73) **Propriétaire/Owner:**
CENOVUS ENERGY INC., CA

(74) **Agent:** MILLER THOMSON LLP

(54) **Titre : SYSTEME DE PUIITS SEPARES HYDRAULIQUEMENT ET PROCEDE DE RECUPERATION**

(54) **Title: HYDRAULICALLY UNITARY WELL SYSTEM AND RECOVERY PROCESS**



(57) **Abstrégé/Abstract:**

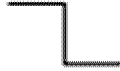
The present disclosure describes a method of recovering viscous hydrocarbons from a subterranean formation using a gravity dominated recovery process with a group of wells, the recovery process incorporating an interwell recovery phase. The group of wells is initially operated independently to establish hydraulic communication between two or more wells in the group. Once hydraulic communication is established, injection of mobilizing fluid and production of hydrocarbons continues in at least one well within the group with an excess amount of mobilizing fluid being injected into the well. At the same time, production only continues in at least one well within the group, without any injection of mobilizing fluid. The wells in the group are spaced closer together than in conventional recovery processes. The recovery process may be SAGD.

ABSTRACT

The present disclosure describes a method of recovering viscous hydrocarbons from a subterranean formation using a gravity dominated recovery process with a group of wells, the recovery process incorporating an interwell recovery phase. The group of wells is initially operated independently to establish hydraulic communication between two or more wells in the group. Once hydraulic communication is established, injection of mobilizing fluid and production of hydrocarbons continues in at least one well within the group with an excess amount of mobilizing fluid being injected into the well. At the same time, production only continues in at least one well within the group, without any injection of mobilizing fluid. The wells in the group are spaced closer together than in conventional recovery processes. The recovery process may be SAGD.

HYDRAULICALLY UNITARY WELL SYSTEM AND RECOVERY PROCESS

[0001]



FIELD

[0002] The present disclosure relates generally to efficient hydrocarbon recovery from subterranean reservoirs using recovery processes and, in particular, to operating wells as a hydraulically connected cluster in an efficient hydrocarbon recovery process.

BACKGROUND

[0003] Recovery of hydrocarbons such as bitumen and heavy oil from reservoirs presents significant challenges due to their high viscosities. Examples of in situ recovery methods for bitumen or heavy oil include steam assisted gravity drainage (SAGD) or cyclic steam stimulation (CSS). These recovery methods involve drilling wells into the reservoir, injecting mobilizing fluids into the reservoir to mobilize the bitumen or heavy oil, and recovering the mobilized bitumen or heavy oil from the reservoir. These recovery processes may include a number of phases. In the case of SAGD, the first phase is a start-up phase where a mobilizing fluid is circulated to mobilized bitumen or heavy oil in the near wellbore region to expedite communication between the wells in a well pair. The second phase of the SAGD recovery process is an operational phase where mobilized fluid is injected into the reservoir and the mobilized bitumen or heavy oil is produced and recovered from the reservoir. The third phase is initiated once operation is no longer economical and the chamber is mature. This phase is referred to as a blowdown phase where fluid such as a non-condensable gas is injected into the reservoir to maintain the pressure in the fluid chamber and allow production to continue without the injection of further mobilizing fluid. The mobilizing fluid is often steam but may also include hot water, light hydrocarbons, solvents, surfactants, non-condensing gases, or mixtures thereof.

[0004] Efficiency of thermal recovery processes, such as SAGD or CSS, is measured by the cumulative steam-oil ratio (cSOR). This is the ratio of cumulative volume of steam injected over the cumulative volume of oil produced. As the

hydrocarbon content of the reservoir is produced and the remaining hydrocarbon content declines, the cSOR will increase. The higher the cSOR, the higher the steam usage. As the cSOR increases, the process becomes less economical. At some point, it may no longer be economical to continue injection of steam or other mobilizing fluid. At this time, fluid injection may be reduced or discontinued and the fluid chamber is now depleted or "mature".

[0005] Hydrocarbon recovery efficiency is also a function of well spacing. If the spacing between wells is too large, recovery efficiency will be reduced. However, well spacing and recovery efficiency is contrasted with the costs of drilling and completing wells. Traditionally, wells are positioned within a reservoir so that drilling and completion costs are minimized. This usually entails placing the wells on wider spacing with the intent that each such well (or well pair, in the case of traditional SAGD) will recover hydrocarbons from as broad an area as is feasible. Standard spacing in a SAGD recovery process using horizontal well pairs typically spaces the well pairs about 75 to 150 meters apart, depending on the specific reservoir and its characteristics.

[0006] When the well spacing selected in a given reservoir is sufficiently large that recovery efficiency is unduly compromised, one well known remedial approach is to drill infill wells between the original wells so as to recover hydrocarbons that would otherwise be bypassed. Infill wells are generally introduced into the reservoir near the end of the operational phase when the hydrocarbon production from the existing wells or well pairs is becoming less economical and bypassed reserves are identified. The infill wells may be operated at the same time as the existing wells and/or after the existing wells are no longer economical and have entered the blowdown phase.

[0007] This approach has the disadvantage of requiring that existing operating wells may be operated inefficiently before bypassed reserves are identified and the reservoir will also require additional wells to be drilled and completed at a later stage in the recovery process with the associated costs of bringing appropriate equipment on site to drill and complete the wells. The overall cost of recovery may therefore be increased.

[0008] There therefore remains a need for a hydrocarbon recovery process that utilizes a well spacing, or well spacing strategy, aimed at efficient oil recovery and minimized overall costs.

SUMMARY

[0009] It is an object of the present method to obviate or mitigate at least one disadvantage of previous systems.

[0010] In one aspect, the present method is a method for producing viscous hydrocarbons from a subterranean formation using a group of wells. The method may include providing two or more wells within a formation, each well having an injection means and a production means. The method may include independently operating a recovery process at each of the two or more wells, the recovery process comprising injecting a first amount of a mobilizing fluid through the injection means into the formation, to mobilize the viscous hydrocarbons in the formation, and producing the mobilized hydrocarbons through the production means. The hydrocarbon recovery process is a predominantly gravity-dominated process. The method may include forming fluid chambers adjacent each of the two or more wells in the reservoir as the mobilized hydrocarbons are produced. The method may include establishing hydraulic communication between the fluid chambers for at least two of the two or more wells to form a cluster of wells. The method may include continuing injection and production from at least one of the two or more wells in the cluster and ceasing injection and continuing production from at least one of the two or more wells in the cluster. The injection of mobilizing fluid in the at least one well in the cluster is a second amount of mobilizing fluid, greater than the first amount of mobilizing fluid. Further, the two or more wells are spaced sufficiently close to establish fluid communication between the two or more wells. The gravity dominated recovery process may be steam assisted gravity drainage operating in horizontal well pairs, or in single vertical, inclined or horizontal wells.

[0011] In a further aspect, the present method is a method for producing viscous hydrocarbons from a subterranean formation using a group of wells. The method includes providing two or more wells within a formation, each well having an injection means and a production means, the injection means being positioned in the well closer to the surface than the production means. The method may also include independently operating a predominantly gravity-dominated recovery method in the two or more wells comprising the steps of injecting a first amount of a mobilizing fluid through the injection means into the formation, to mobilize the viscous hydrocarbons; and substantially concurrently producing the mobilized hydrocarbons through the production means, wherein producing the mobilized hydrocarbons forms fluid chambers in the formation adjacent each of the two or more wells. The method may also include establishing

hydraulic communication between the fluid chambers formed adjacent at least two of the two or more wells to form a cluster of wells. The method may also include continuing injection and production from at least one of the two or more wells in the cluster and ceasing injection and continuing production from at least one of the two or more wells in the cluster. The injection of mobilizing fluid in the at least one of the two or more wells in the cluster is a second amount of mobilizing fluid greater than the first amount of mobilizing fluid. Further, the two or more wells may be spaced sufficiently close to establish fluid communication between the two or more wells. The gravity dominated recovery process may be steam assisted gravity drainage, operated in horizontal well pairs, or in single vertical, inclined or horizontal wells.

[0012] Other aspects and features of the present disclosure will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Aspects of the present disclosure will be described by way of example only with reference to the attached figures.

[0014] Figure 1 is a graph showing the cumulative steam oil ratio (cSOR) for a simulation of a base case of vertical wells operating single vertical well SAGD as compared to vertical wells operating the present method.

[0015] Figure 2 is a graph showing the cSOR for a simulation of a base case of horizontal well pairs operating SAGD as compared to horizontal well pairs operating the present method.

[0016] Figure 3 is a graph showing the oil recovery for the simulation shown in Figure 2.

DETAILED DESCRIPTION

[0017] The present method provides for the efficient recovery of unmobilized hydrocarbons using a recovery process and a number of closely spaced wells which begin as separate entities operating under a gravity dominated process, but which evolve into an operational group of interconnected wells. The present method thus includes an inter-well recovery stage involving a hybrid of gravity and convective processes during the operational phase and sufficiently close well spacing to allow the

inter-well recovery phase to recover hydrocarbons in an efficient manner. This process may eliminate the need for infill wells to be drilled and completed in the reservoir.

[0018] By using a closer well spacing than traditionally selected for a group of wells, in conjunction with a recovery process which includes an inter-well operational phase, hydrocarbon recovery may be improved.

[0019] The present method positions wells at a closer spacing than is traditionally used in reservoirs. The well spacing used in the present method is sufficiently close so that there may no longer be a need for subsequent infill wells during the life of the inter-well phase of the recovery process. Although this may require additional wells to be drilled and completed at an earlier stage in the recovery process than with traditional recovery processes, the present method provides for an improved overall hydrocarbon recovery than is achieved using traditional methods with wider well spacing and no inter-well operational phase.

[0020] In the present method, well groupings or "clusters" are used for inter-well operation. The group of wells comprises two or more wells. The wells are spaced sufficiently close within a reservoir so that although the wells are initially operated independently, hydraulic communication between the wells is established at a later point in the wells' operational phase.

[0021] Once hydraulic communication is established between the wells, an inter-well recovery process phase is initiated so that the group of wells forms an operational cluster of wells. The number of wells that form the cluster may vary over time. The hydraulic communication between wells within a group may be established simultaneously or sequentially. Further, variations in operating conditions and/or reservoir properties may mean that all wells may not communicate discernibly. Thus, an initial group of wells may evolve into two or more subgroups, each of which constitutes a cluster of communicating wells, but between or among which clusters there is no discernable communication. Communication between these clusters or subgroups of wells may be established over time.

[0022] Hydraulic communication in this context refers to the merger or coalescence of mobilized zones between or among wells. The mobilized zones may include fluid chambers, such as steam chambers, formed as a result of the thermal recovery processes and injection of heated fluids. The occurrence of the merger or coalescence is measurable by means known within the field, such as pressure monitoring at the wells.

[0023] Once the wells form a cluster with inter-well hydraulic communication, the wells are operated such that at least one well in the cluster continues operating both injection and production in its recovery process, such as a single vertical well SAGD mode or SAGD recovery process using horizontal well pairs. The operations at the other wells in the cluster may be modified so that there is at least one well within the cluster that will cease operating the recovery method and instead will be placed on production only with no injection of mobilizing fluid. Within the cluster, only one well may continue with the recovery process with both injection and production while all of the remaining wells in the cluster are placed on production only. In a further aspect, the well continuing with both injection and production may cease production for a period of time. In a further aspect, production in one or more of the wells within the cluster may alternate with periods of shut in to allow for further time for mobilization of the hydrocarbons in the reservoir.

[0024] During this inter-well operational phase, the at least one well that remains operating in the recovery process will inject mobilizing fluid into the reservoir in an amount in excess of the amount required for that well. The excess mobilizing fluid will therefore move laterally and downward in the reservoir towards the pressure sinks at the other wells in the cluster. The pressure sinks are the result of the discontinued injection of mobilizing fluid and the continued production of hydrocarbons. The amount of excess mobilizing fluid injected to operate the recovery process at all of the wells in the cluster will be a function of many factors, including well spacing and reservoir characteristics. Governance of the amount of excess mobilizing fluid to be injected may be established by monitoring cSOR and production rates at all of the wells and making adjustments to injection and production rates so as to optimize economics or other key performance indices.

[0025] As the inter-well recovery process continues in the cluster, the fluid chambers mature and the steam-oil ratio increases. At some point, the process will transition to the blowdown phase. At this point, the wells may continue to operate as a cluster with non-condensing gas injected into the well(s) operating the recovery process while the remaining wells continue production until the cluster reaches its economic limit.

[0026] The roles of the wells within the cluster are flexible. Once the wells have established hydraulic communication and are operating as a cluster with inter-well operations, the recovery process carried out at each well may vary. For example, if one well is undergoing both injection and production for SAGD while the remaining wells are

producing with no injection, the well that is undergoing SAGD may cease injecting steam and only produce hydrocarbons while another well within the cluster may be re-activated to operate SAGD with both injection and production. Wells within the cluster may be re-purposed generally over the operational and blowdown phases to allow for efficient hydrocarbon recovery from the reservoir.

[0027] In one example of the present method, a single vertical or inclined well SAGD process is used as the thermal recovery process operating in the wells. Single vertical or inclined well SAGD process is described in more detail in U.S. patent application 14/195,518. In the single well SAGD process, the vertical or inclined well includes an individual wellbore whose openings to the reservoir have been configured to allow for concurrent injection and production. The injection and production intervals in the wellbore are isolated from each other. Steam or other mobilizing fluids are injected through an upper open interval in the wellbore and mobilized fluids are produced from a lower open interval in the same wellbore, in a gravity-dominated process. There is a convergence of flow toward and into the bottom producing interval. The reservoir may have a high mobility zone located substantially opposite the producing interval of the single vertical well. The high mobility zone may be either pre-existing or artificially established.

[0028] The present example involves two single vertical well SAGD wells spaced apart to form a group of wells. In this example, the well spacing uses a 5 spot pattern, which is a general square shape with a well at each corner and one well in the middle. In the simulation, only two wells are operating, the center well and a corner well. The well spacing is 75 meters along the edge of the square, between wells in each corner. The wells are initially operated as individual wells using a single well SAGD process in a start-up and operational phase. A start-up phase is implemented at each individual well to mobilize hydrocarbons in the immediate vicinity of the well and thereby provide an initial means for vertical flow. A typical start up process would involve the circulation of steam or other mobilizing fluid within the wellbore for a period of time sufficient to achieve adequate mobilization of the hydrocarbons within the reservoir in the vicinity of the wellbore. Other start-up processes include electrical or electromagnetic heating or the injection of non-thermal fluids such as solvent.

[0029] Following the start-up phase, the single well SAGD process is operated at each well, independently of other wells, by injecting steam or other fluids into the injection means and producing fluids from the production means. During operation,

vertical flow in the reservoir in the vicinity of each well is facilitated and/or impediments to steam chamber growth may be avoided by creating a basal mobile zone opposite the production means or using an existing mobile zone within the reservoir opposite the production means. The injected steam may also include a solvent or surfactant. In some cases, particularly when a mixture of steam and solvent or surfactant is injected, it is not necessary to create a basal mobile zone.

[0030] Operation of the wells independently continues until the steam chambers for one well communicates hydraulically with the steam chambers for one or more other wells, whether simultaneously or sequentially. In the simulation, as shown in the graph in Figure 1, hydraulic communication between wells is established at about 700 days. At this point, the wells form a cluster and are hydraulically joined.

[0031] The wells within the cluster are operated so that at least one well in the cluster continues operating a single vertical or inclined well SAGD process with injection of steam through the injection means and producing of fluids through the production means. In the 5 spot pattern, the well in the center of the square shape continues operating both injection and production. The other well in the cluster, namely the well positioned at one of the corners of the square shape of the 5 spot pattern, cease its SAGD process by ceasing to inject steam through the injection means but will continue production of fluids through the production interval. The (center) well which continues to operate a SAGD process may inject an excess of steam over and above that required for the single well SAGD process. The excess steam will move laterally and downwards toward the pressure sinks at the production means of the other well in the cluster. The pressure sinks are the result of discontinued injection into the upper intervals and the continued production from the lower intervals.

[0032] As the cluster based recovery process matures, and the steam-oil ratio increases, the cluster will transition to the blowdown phase. In this phase, non-condensing gas may be injected into the upper interval of the injector or injectors within the cluster and these and the other wells within the cluster will continue production of fluids from their production intervals until they reach their economic limit.

[0033] Figure 1 is a graph showing the cSOR ratio for the simulated operational period for the two single vertical well SAGD wells operating the present method (B) as compared to a base case with using two single vertical wells operating only single vertical well SAGD for the entire operational period (A). Figure 1 shows that the cSOR is lower in the wells using the present method.

[0034] Once the wells transition into operation as a cluster, the wells may be repurposed for efficient hydrocarbon recovery. This may occur at any phase of the overall recovery process within the cluster. As set out above, only one well in the cluster needs to operate in a single well SAGD mode but multiple wells may do so. The remaining wells, including at least one well, will operate in a production only mode, without an injection of steam through their wellbores. Further, during this operational phase, the process within a particular well in a cluster may change, with the well undergoing the single well SAGD process changing to production only and one or more different wells in the cluster changing from production only to undergoing the single well SAGD process.

[0035] Also, within the overall recovery process as described, and consistent with sound oilfield operating practice, cyclic stimulation, such as cyclic steam stimulation, may be practiced from time to time at individual wells to enhance reservoir transmissibility in the vicinity of those wells.

[0036] The process is described with the injection of steam as an example. However, any suitable fluid and/or additive may be injected into the reservoir including but not limited to steam, hot water, light hydrocarbons, solvents, surfactants, non-condensing gases including light hydrocarbons and oxygen comprising gases, or mixtures thereof.

[0037] The process is described using single vertical or inclined well SAGD as an example. However, other gravity dominated recovery processes may also be used in the present method. These include, but are not limited to, single horizontal well SAGD and SAGD using horizontal well pairs. All of these gravity dominated recovery processes, and the hybrid processes employed during the follow-up inter-well phase, may include additives or alternatives to steam, such as hot water, solvent, surfactant, and non-condensing gas, including oxygen comprising gas.

[0038] In SAGD using horizontal well pairs, a simulation was run to assess hydrocarbon recovery and cSOR when using SAGD operating in the well pairs and comparing it to operating the method of the present invention. The base case operated SAGD in two horizontal SAGD well pairs for 3650 days (10 years). A comparative example operated SAGD in the two SAGD horizontal well pairs for 1200 days (over 3 years). At this point, hydraulic communication was determined to be established between the SAGD well pairs. The two well pairs could now be operated as an interwell group or cluster of wells. One injector was shut in so that the injection of steam ceased in one well pair. The injection of steam continued in the other well pair. Both well pairs

continued production. The well pairs were operated up to 3650 days. As shown in Figure 2, the data showed substantially identical cSOR for both cases of approximately 2.5. The comparative case using the present method had a slightly higher hydrocarbon recovery as shown in Figure 3 as compared to the base case operating SAGD throughout the life of the SAGD well pairs. The overall result is that the present method is more efficient since more hydrocarbons were recovered using a substantially same amount of steam as the SAGD process.

[0039] Reference is made to exemplary aspects and specific language is used herein. It will nevertheless be understood that no limitation of the scope of the disclosure is intended. Alterations and further modifications of the features described herein, and additional applications of the principles described herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of this disclosure. Further, the terminology used herein is used for the purpose of describing particular embodiments only and is not intended to be limiting. The scope of the claims should not be limited by the preferred embodiments set forth herein but should be given the broadest interpretation consistent with the description as a whole.

CLAIMS:

1. A method of producing viscous hydrocarbons from a subterranean formation using a group of wells, the method comprising:
 - providing two or more wells within a formation, each well having an injector and a producer;
 - independently operating a predominantly gravity-dominated recovery process at each of the two or more wells, the recovery process comprising injecting mobilizing fluid at a first rate of injection, through the injector into the formation, to mobilize the viscous hydrocarbons in the formation, and producing the mobilized hydrocarbons through the producer;
 - forming fluid chambers adjacent each of the two or more wells in the reservoir as the mobilized hydrocarbons are produced;
 - establishing hydraulic communication between a fluid chamber adjacent a first one of the two or more wells and a fluid chamber adjacent a second one of the two or more wells to form a cluster of wells;
 - continuing injection into and production from the first one of the two or more wells in the cluster and ceasing injection and continuing production from the second one of the two or more wells in the cluster,
 - wherein a rate of injection of mobilizing fluid in the first one of the two or more wells in the cluster is increased to a second rate of injection of mobilizing fluid that is greater than the first rate of injection; and
 - wherein the two or more wells are spaced sufficiently close to establish fluid communication between the two or more wells.
2. The method of claim 1 further comprising ceasing injection into and continuing production from the first one of the two or more wells, and reinitiating injection of the mobilizing fluid into and continuing production from the second one of the two or more wells.
3. The method of claim 1 further comprising ceasing injection of the mobilizing fluid into the first one of the two or more wells, and injecting a non-condensable gas through the first one of the two or more wells while continuing production at the second one of the two or more wells in the cluster.

4. The method of any one of claims 1 to 3 wherein the cluster of wells is operated as a hydraulic unit.
5. The method of any one of claims 1 to 4 wherein the wells in the cluster are spaced so that infill wells are not required.
6. The method of any one of claims 1 to 5 wherein the recovery process is steam assisted gravity drainage (SAGD) and the two or more wells within the formation are selected from the group consisting of SAGD well pairs or single vertical, inclined, or horizontal SAGD wells.
7. The method of any one of claims 1 to 6 wherein the mobilizing fluid is steam, hot water, light hydrocarbon, solvent, surfactant, non-condensing gas, or mixtures thereof.
8. The method of claim 7 wherein the solvent is one or more of a C3 to C10 solvent or hexane, or wherein the non-condensing gas is a light hydrocarbon or an oxygen containing gas.
9. The method of any one of claims 1 to 8 wherein the injecting or producing or both injecting and producing is carried out on a continuous basis.
10. The method of any one of claims 1 to 9 wherein the viscous hydrocarbons are selected from the group consisting of bitumen, heavy oil, and unmobilized hydrocarbons.
11. The method of any one of claims 1 to 10 wherein the recovery process further comprises, as an aid, cyclic stimulation.
12. The method of claim 11 wherein the cyclic stimulation is cyclic steam stimulation (CSS).

13. A method of producing viscous hydrocarbons from a subterranean formation using a group of wells, of the method comprising:
- providing two or more pairs of wells, including a first pair comprising a first injection well and first production well, and a second pair comprising a first injection well and first production well;
 - independently operating a predominantly gravity-dominated recovery method in the two or more pairs of wells comprising injecting a mobilizing fluid at a first rate of injection, through the first injection well, to mobilize the viscous hydrocarbons; and producing the mobilized hydrocarbons through the first production well, and injection a mobilizing fluid at a second rate of injection, through the second injection well to mobilize the viscous hydrocarbons and producing the mobilized hydrocarbons through the second production well, wherein producing the mobilized hydrocarbons from the first production well and the second production well forms fluid chambers in the formation adjacent the first production well and the second production well;
 - establishing hydraulic communication between a fluid chamber formed adjacent the first production well and the fluid chamber adjacent the second production well to form a cluster of wells; and
 - continuing injection into the first injection well and production from the first production well in the cluster and ceasing injection into and shutting in the second injection well, and continuing production from the second production well in the cluster, wherein the injection of mobilizing fluid in the first injection well is carried out at a third rate of injection, greater than the first rate of injection;
 - wherein the two or more wells are spaced sufficiently close to establish fluid communication between the two or more wells.
14. The method of claim 13 further comprising ceasing injection into the first injection well and shutting in the first injection well, continuing production from the first production well, reinitiating injection of the mobilizing fluid into the second injection well, and continuing production from the second production well.
15. The method of claim 13 further comprising the step of ceasing injection of a mobilizing fluid into the first injection well, and injecting a non-condensable gas into the first injection well while continuing production at the second production well.

16. The method of any one of claims 13 to 15 wherein the cluster of wells is operated as a hydraulic unit.

17. The method of any one of claims 13 to 16 wherein the recovery process is steam assisted gravity drainage (SAGD) and the two or more wells within the formation comprise SAGD well pairs.

18. The method of any one of claims 13 to 17 wherein the mobilizing fluid is steam, hot water, light hydrocarbon, solvent, surfactant, non-condensing gas, or mixtures thereof.

19. The method of claim 18 wherein the solvent is one or more of a C3 to C10 solvent or hexane, or the non-condensing gas is a light hydrocarbon or an oxygen containing gas.

20. The method of any one of claims 13 to 19 wherein the viscous hydrocarbons are selected from the group consisting of bitumen, heavy oil, and unmobilized hydrocarbons.

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Figure 1

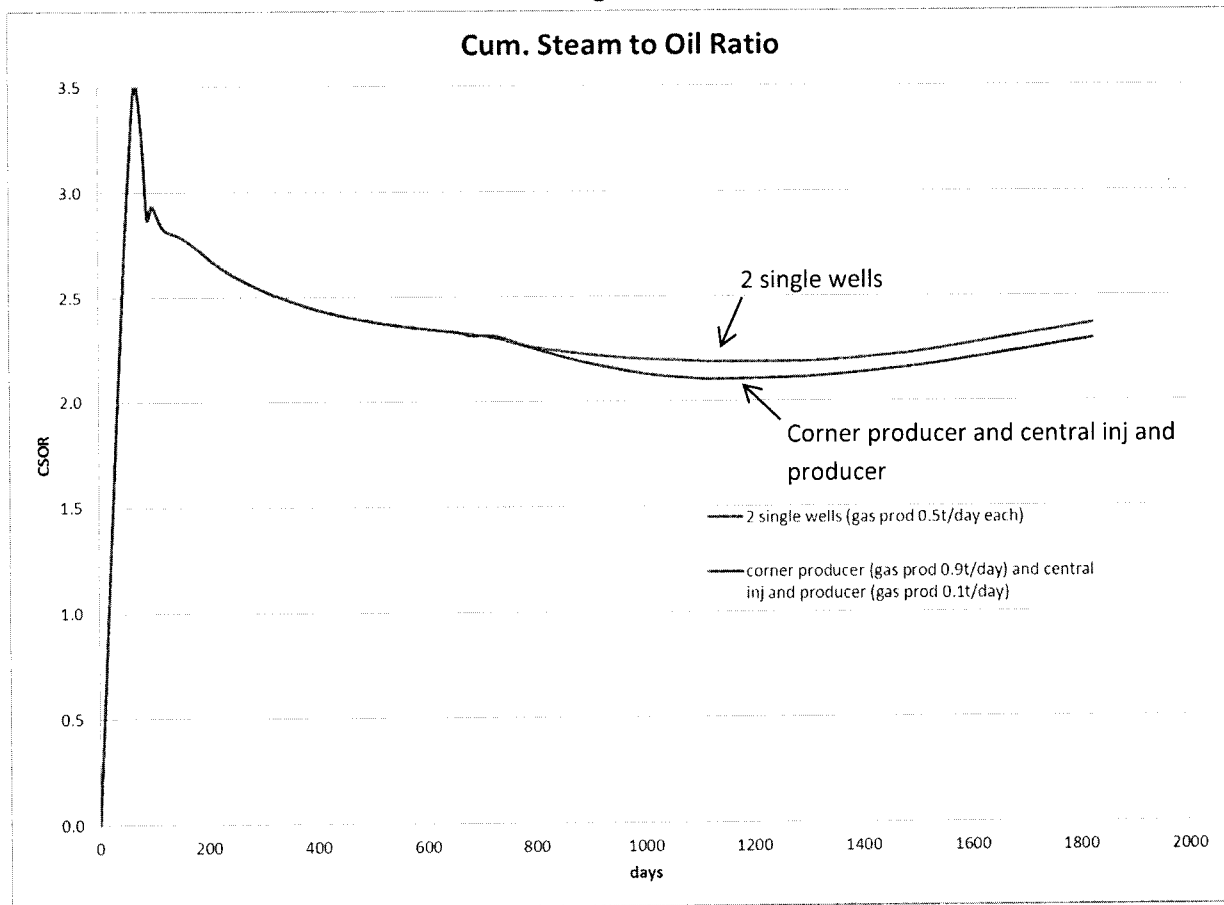


Figure 2

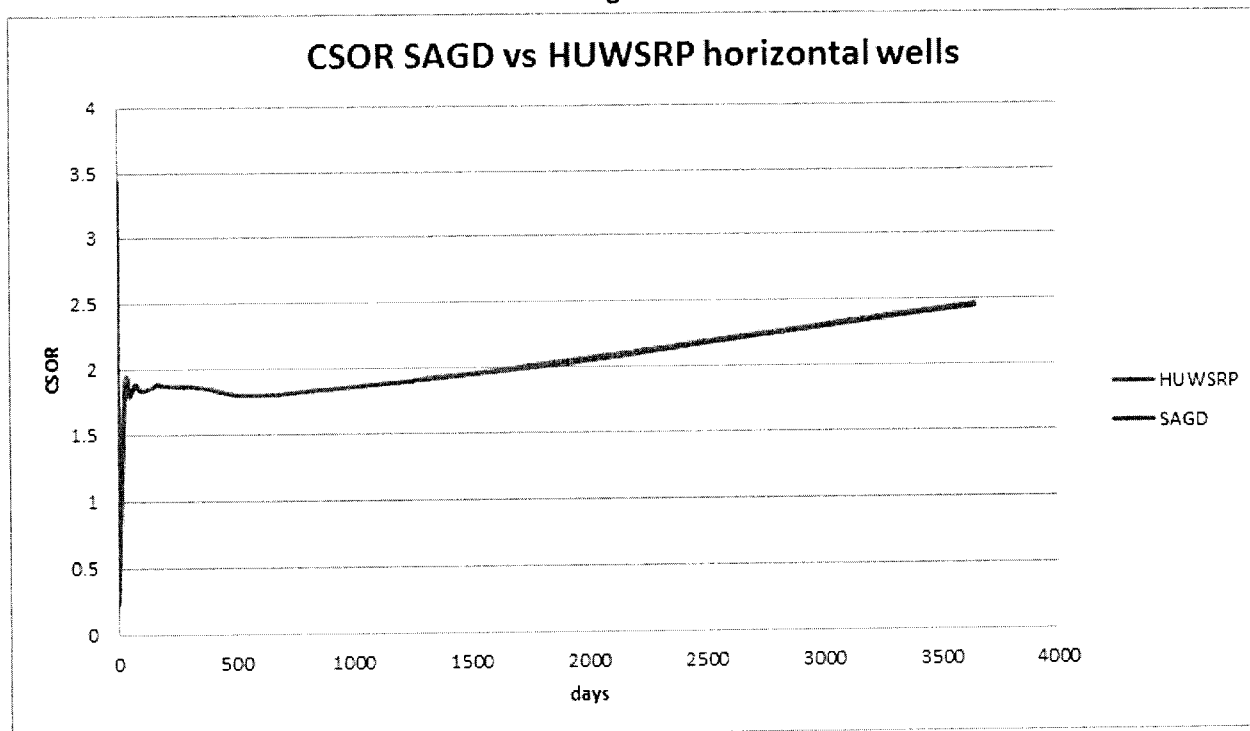
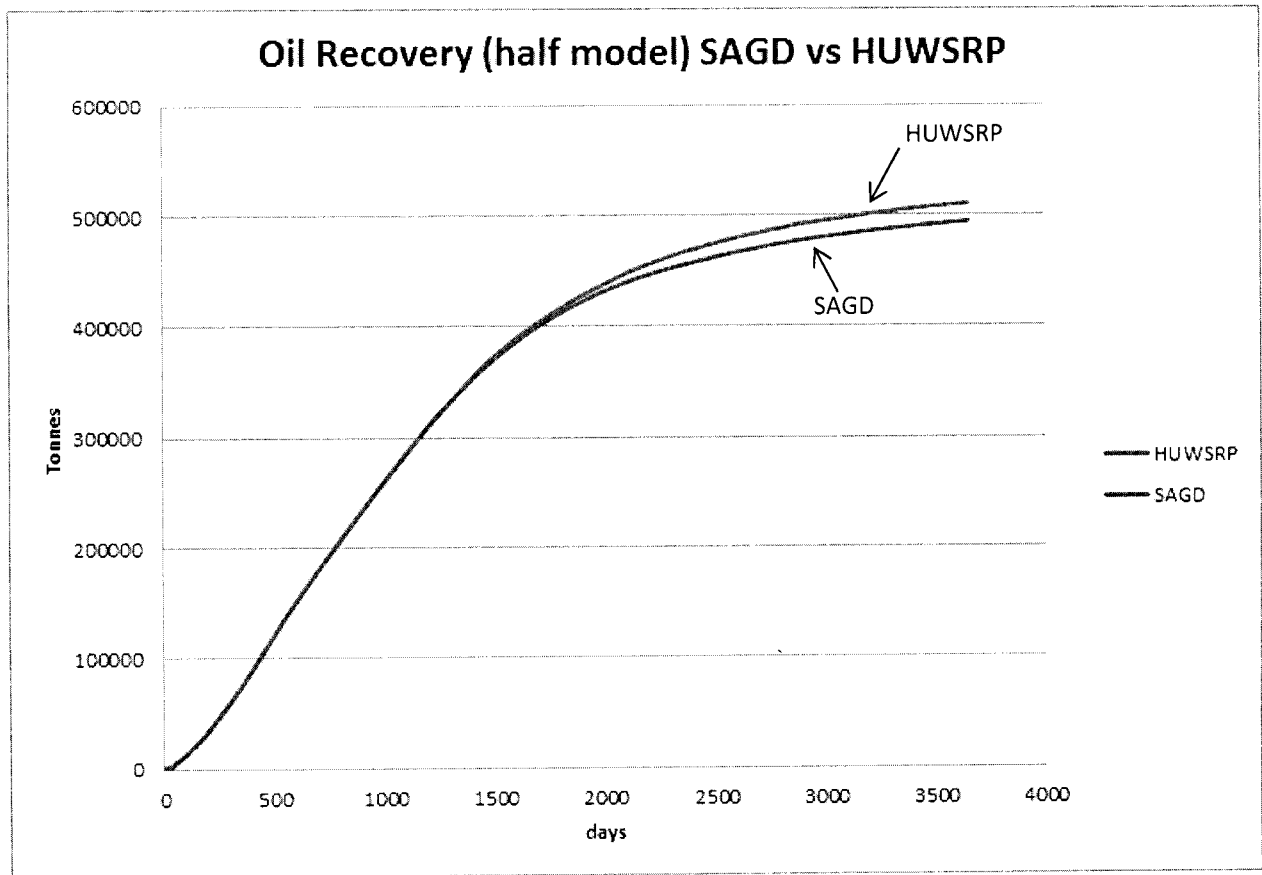


Figure 3



Cum. Steam to Oil Ratio

